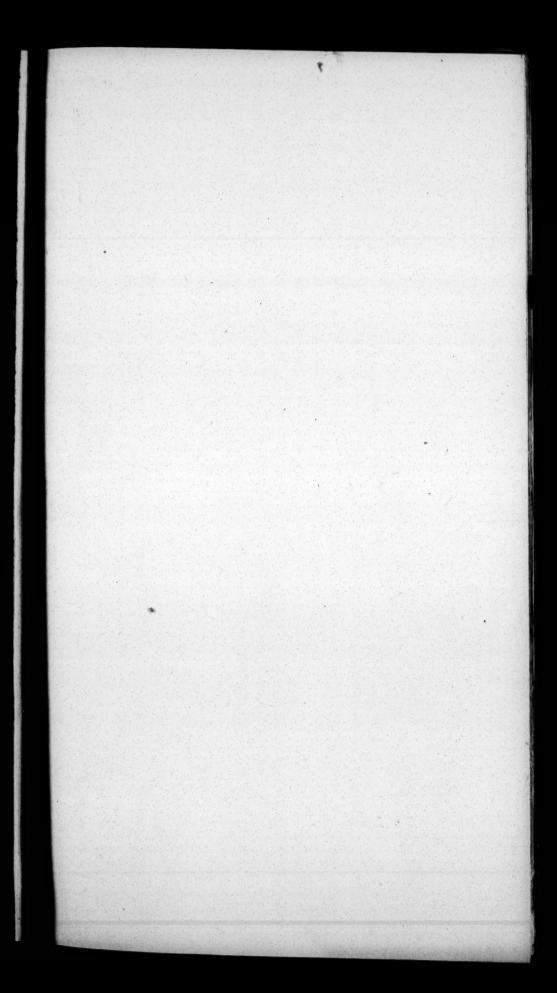
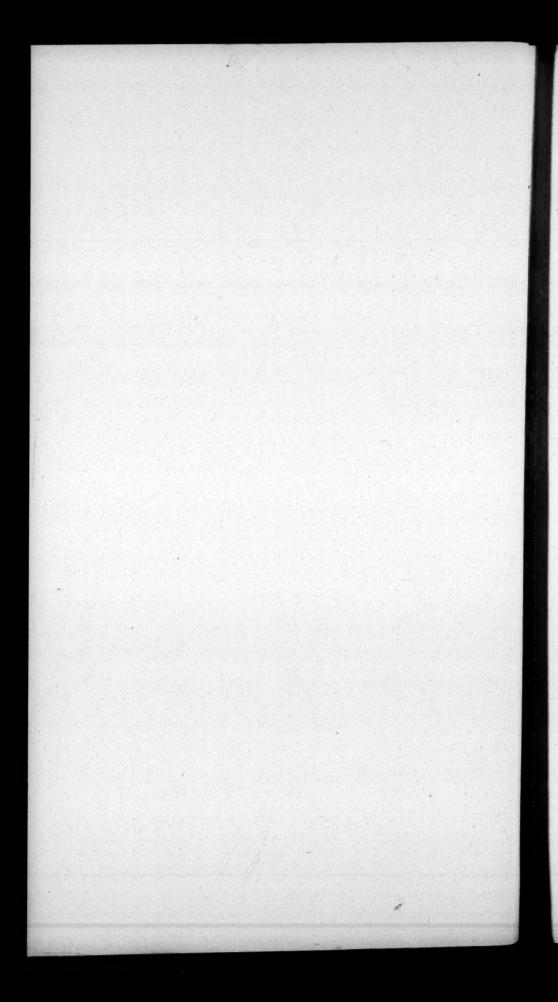
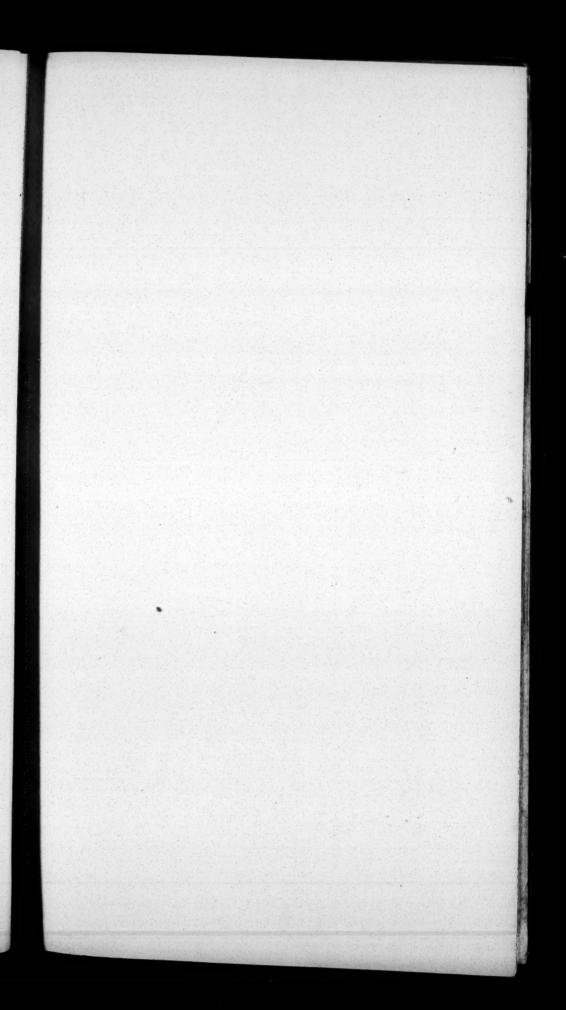
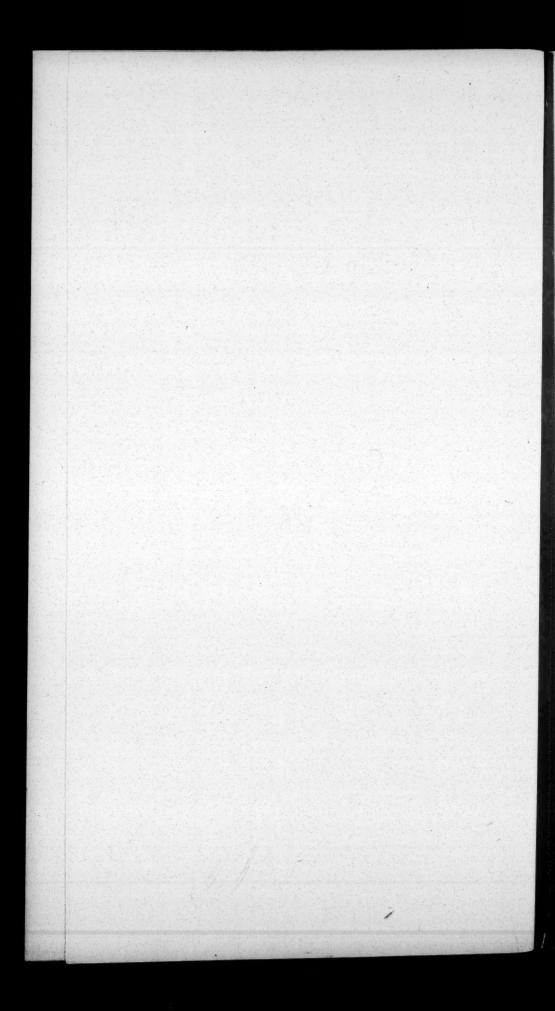
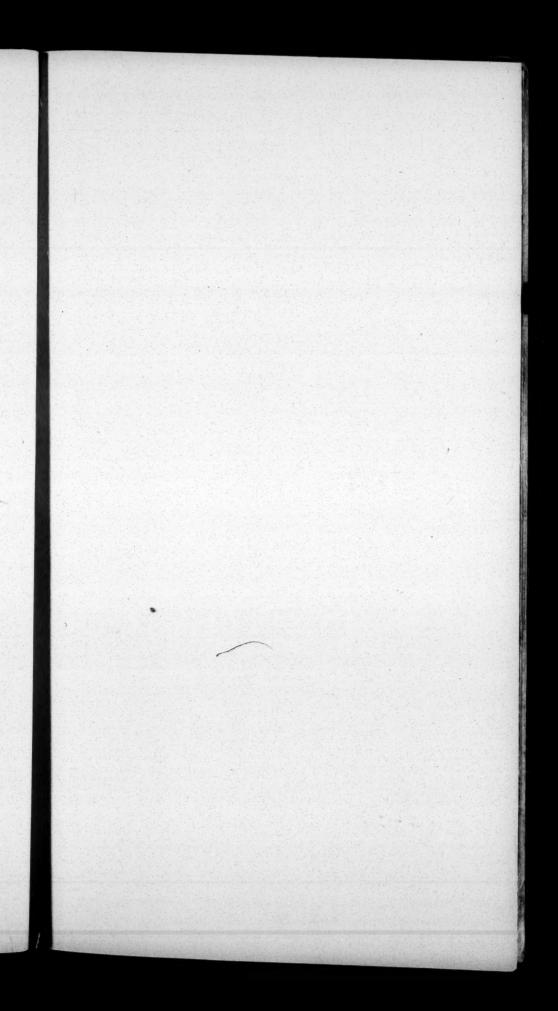
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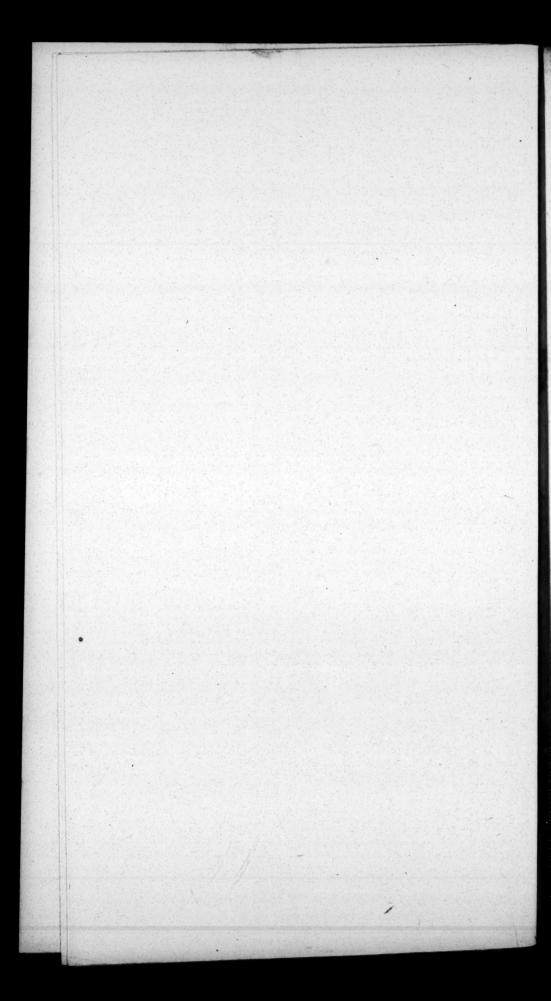












TUTOR'S GUIDE,

BEING

A Complete System of Arithmetic;

WITH

Various Branches in the MATHEMATICS. IN SIX PARTS, VIZ.

I. Arithmetic in all its ufeful Rules, and to each a great Variety of Questions.

11. Vulgar Fractions, in all their

Parts.

- III. Decimal Fractions, with the Extraction of Roots of different Powers; to which are added, Rules, &c, for the easy Calculation of Interest and Annuities, &c.
- IV. Menfuration of Superficies and Solids, applied to measuring Artificers Work, &c. with a Collection of Questions for Exercise.

To which is added, the specific Gravity of Metals, &c.

V. Chronology, or the Method of finding the feveral Cycles, Epacts, Moveable Feafts, Time of High Water, &c. with a Collection of Questions relating to History; likewise all the most useful Examples on both the Globes.

VI. Algebra, wherein the Method of raising and resolving Equations is rendered easy, and illustrated with Variety of Examples and Numerical Questions.

TO WHICH IS ADDED,

AN APPENDIX.

Containing different Forms of Acquittances, Bills of Exchange, &c. &c.

The whole being defigned for the Use of Schools, as a Question Book, or a Remembrancer and Instructor to such who have some Knowledge of Figures, and is adapted for the Use of the Gentleman and Schoolar, as well as for the Man of Business: And is recommended by several eminent Mathematicians and School-masters.

The SIXTH EDITION, corrected and improved, with Additions.

By CHARLES VYSE.

Author of the Young Ladies' and Gentlemen's New Guide to the English Language, &c. and Master of the Academy at West Ham Abbey, Effex.

LONDON:

RINTED FOR G. G. J. AND J. ROBINSON, PATER-NOSTER-ROW.

MDCCLXXXV.

The MONTHLY REVIEW, for January 1771, gives the following Account of the first Edition.

"The best Method of conveying Instruction is derived from Experience: and though the Author of the Tutor's Guide does not pretend to boast of new Discoveries, yet it must be allowed, that he has selected a great Variety of neceffary and useful Rules for the obtaining a thorough Knowledge in those Sciences which depend upon Arithmetic: And his Book will be found particularly useful in this Respect, as it contains a very confiderable Number of Questions to exemplify the Rules he has laid down, and to exercise the Attention of the Learner.-Many of them may be thought to furpass the Capacity of young Scholars; but this Circumstance is no just Objection against the Book itself; it rather recommends the Work to an after Review, when the Understanding is enlarged and ripened. The Plan and Execution of Mr. Vyse's Performance do Honour to his Judgment and Application, and entitle it to the general Notice of those who are entrusted with the Education of Youth."

The CRITICAL REVIEW gives the following Account.

Notwithstanding there are many Books already extant, upon the same Subject, yet we apprehend that the Work before us will not be deemed either unnecessary or impertinent, after having assured our Readers, it is recommended to the Favour of the Public by one of the most considerable Mathematical Writers of the present Age,"

REVEREND MR. VYSE,

Archdeacon of SALOP, mon Residentiary of the Church of LICHFIELD, And Rector of St. Philip's Church in BIRMINGHAM,

THIS

YSTEM OF ARITHMETIC

I S,

With the utmost Deference,

Inscribed by,

e or

1-

His most obliged humble Servant,

CHARLES VYSE.

1578 3974

THE

PREFACE.

WHEN we consider the Utility of ARITHMETIC, on which Science almost all the others do absolutely depend, we need not be surprised that so many Efforts have been made to bring this useful Branch of Learning to the utmost Degree of Perfection: and although the vast Extent of the Subject does in some Measure deseat these Attempts; yet, upon Account of its real Value and Use, it certainly merits all the Study and Pains that can be bestowed upon it.

In the following Pages I have delivered the Definitions and Rules in as brief and concife a Manner as I possibly could, so as to make them general; and they follow in the same Order as specified in the Table of Contents: Thus, Book the First contains the four primary Rules, i. e. Addition, Subtraction, Multiplication, and Division, in Integers, and Reduction, ascending and descending, with the Tables of Money, Weights, Measures, &c. with which the Pupil should be well acquainted, before he proceeds to the Use of those Rules in Compound Numbers.

In Book the Second, the Rules follow in the fame Order in which they are generally taught

A 3

in Schools; but I apprehend the most expeditious Method for the Pupil would be to learn as far as the Rule of Three, then Vulgar and Decimal Fractions, the Extraction of the Square and Cube Roots; after which a larger field may be opened to him, as he will be more capable to judge for himself, and (with a little Assistance from the Master) go through any Rule, to his own Satisfaction and his Teacher's Honour. But in Schools the Master very seldom either knows the Business for which his Scholars are designed, or the Length of Time they are to continue at School, and is therefore obliged to pursue the old beaten Path, and teach them first, what is not perhaps the most essential.

In this Work, amongst several hundred Questions, are all those most excellent ones of the late Martin Clare, ranged according to the several Rules to which they appertain, a Thing wished for by School-masters and Teachers in

general.

I pretend not to boast of new Discoveries, but slatter myself to have selected every necessary and useful Rule or Proposition for obtaining a thorough Knowledge in those Sciences which depend upon Arithmetic; and have given a great Variety of such Questions as will enable the Tutor to supply his Pupils with those that may be most conducive to the Station of Life for which they may be designed.

I have felected the most difficult Questions of

each Rule, as Exercifes for leifure Hours.

And,

And, in order to make this Book as useful as possible, I have added several examples of the different Forms of Acquittances, Promissory Notes, Bills of Exchange, Bills of Parcels, &c. the frequent copying of which I would recommend to the Pupil.

I have not adjoined the Answers to the Questions, as I have published (by Desire of several Mathematicians and School-masters), a Key to the Tutor's Guide, wherein all the Answers are worked at Length, with proper References to the Questions as they stand in this Edition.

I need not point out the great Utility of such a Performance; it is sufficiently evident to all who are employed in this Branch of Education, especially such as have the Care of a numerous School, and experience the Difficulties that Teachers in general labour under with Respect to Time; a Grievance that must still continue, while the Prices they receive are so very inadequate to their Labours.

I hope the Gentlemen of the Profession will do me the Justice to believe, that my Design in this Performance was not to dictate to, but ease the Master; and the skilful Teacher will, no Doubt, vary the Work of the Questions according to the Nature of the several Rules.

The TUTOR'S GUIDE and its KEY furnish a Complete System of ARITHMETIC, and will enable those, who are acquainted with the first Principles, to attain (without the Assistance of a Master) a competent Knowledge of the several Rules with Ease and Precision.

By the particular Desire of many eminent School-masters, an Abridgement of the Guide is published with this Addition, entitled the Young Arithmetician's Assistant; wherein is contained only what is most immediately necessary for the lower Forms, and those designed for Trade or Business; the Guide being thought too expensive to put in the Hands of young Beginners, therefore put it out of the Power of many Masters, particularly those who keep Day Schools, to make use of in their Schools. The Abridgement has the same Advantage with respect to the Key as the Guide.

The favourable Reception the former Editions have met with gives me Room to hope, that the Alterations and Additions I have made in this, will merit the Approbation of those Gentlemen who have kindly interested themselves in Behalf of my former Endeavours, to whom I return my

most fincere Thanks, and am,

With the utmost Esteem and Respect,

Their's and the Public's much obliged,
obedient humble Servant,

WEST HAM ABBEY,]

CHARLES VYSE.



THE

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EXPLANATION of the CHARACTERS made Use of in this BOOK.

Signs. Names. Significations. + Plus, or more, The Sign of Addition, as 6+2 is 8. Minus, or less, The Sign of Subtraction, as 6-2 is 4. × S Multiplied The Sign of Multiplication, as 6×2 into, or by is 12. The Sign of Division, as 6 = 2 is 3. Divide by Equal to The Sign of Equality, as 6+2=8. : [Is to The Signs of Proportionals, as :: \ So is 2:4::6:12. V { Extraction } of the Roots. } The Square Root of 9=3 is 2 19=3, and the Cube Root of 8=2 is 3 1/8=2. 6-4×9=18; Signifies, that 6 less 4 multiplied by 9=18.

The Twelve SIGNS of the ZODIAC.

Y Aries, the Ram.
N Taurus, the Bull.
II Gemini, the Twins.
Cancer, the Crab.
Leo, the Lion.
N Virgo, the Virgin.

Libra, the Balance.

M Scorpio, the Scorpion.

Sagittarius, the Archer.

Capricornus, the Goat.

Aquarius, the Waterbear.

* Pifces, the Fishes.



THE

TUTOR'S GUIDE,

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E

BEING

A Complete System of Arithmetic.

BOOK I.

Arithmetic in whole and compound Numbers.

1. INTRODUCTION.

A RITHMETIC is the Science, or Knowledge of Numbers, which is either Unit, or Multitude of Units.

Unit is any Thing confidered as one, or 1.

Digits, or Figures, are the Marks by which Numbers are denoted or expressed, and are the nine following, viz. 1, 2, 3, 4, 5, 6, 7, 8, 9; with these there is used the Mark o, called a Cypher, which of itself stands for nothing, but being annexed to the Right-hand of a Digit, alters its Value, thus 40 signifies forty, and 400 stands for four hundred, &c. (See the following Table.)

Integers, or whose Numbers are such as express a Number or Multitude of Things, whereof each is considered as an Unit. Thus, 6 Pounds, 12 Yards, 140 Miles, &c. each

of which is called an Integer, or whole Number.

Compound Numbers are fuch as confift of different Denominations, as Pounds, Shillings, Pence, and Farthings; or Hundreds, Quarters, Pounds, Ounces, &c.

Thus, 471, 12s. 64d. or 4 C. 2 qrs. 14 lb. &c.

B 19

A

A Fraction, or broken Number, is always less than Unit, as $\frac{3}{4}$ represents three Quarters of any Thing or Unit, and $\frac{6}{8}$ is fix-eighths of Unit or 1, &c.

Arithmetic, with regard to Art and Science, confifts both

in Theory and Practice.

Theory confiders the Nature and Quality of Numbers,

and demonstrates the Reason of Practical Operations.

The Practice is that which shews the Method of working by Numbers, so as to be the most useful and expeditious for Business, and has five principal or fundamental Rules for the Operation, viz.

1. Numeration of Notation. 2. Addition. 3. Subtraction. 4. Multiplication. And, 5. Division.

I. NUMERATION

TEACHETH to read, or express the true Value of any Number when writ down; and consequently to write down any proposed Number according to its true Value; and this consistent of two Parts.

1. The due Order of placing down Figures.

2. The true valuing of each Figure in its Place, both of which are plainly exhibited in the following

T A B L E.

. G Hundred of Millions.	. o oTens of Millions.	suoillions.	•	+ o o o Hundred of Thoulands.	+ 0000 Tens of Thoulands.	+ o o o o o Thoufands.	• • • • • • • • • • • • • • • • • • • •	+ o o o o o o Hundreds.	+ 0000000 Tens.	+ 0000000 u Units.	
										4	

EXAMPLES.

S

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r

r

B -

te

;

of

Write down the Value of the following Numbers, in Words at length, viz. 94, 762, 3024, 37460, 142613, 6040390, 47639121, 790401950, and 79041955.

In Figures express

Seventy-seven. Four hundred and ninety. Six thousand and fifty-five. Seventeen thousand seven hundred and nine. Eight hundred thousand and two. Seven millions forty-four thousand and seventy-sour. Six hundred. Ninety-sour millions. Four hundred thousand and sixty.

NOTATION.

By ROMAN Numerical Letters.

One, five, ten, fifty, hundred, five-hundred, thousand. I, V, X, L, C, D, M.

When a less numerical Letter stands before a greater, it must be taken from it, as I before V or X, and X before L or C, &c. Thus,

four, nine, forty, ninety, &c. IV. IX, XL, XC.

IV, IX, XL, XC.
When a leffer numerical Letter stands after a greater, it is
to be added to it. Thus,

fix, eleven, fixty, one hundred and ten.

VI, XI, LX, CX.
A Line drawn over any Number less than a Thousand,

A Line drawn over any Number less than a Thouland, fignifies so many Thousands, as LX, is fixty Thousand, C is one hundred Thousand, M, is one Million, &c.

Write down in common Figures the following Numbers expressed in Numerical Letters, viz.

XIX, CC, DC, DLX, MI, MDCCL, LXX, CX, MD, MDC.

Write down in numerical Letters the following Numbers expressed in common Figures, viz.

29, 104, 419, 1741, 2007, 17678, 10004, 674084.

B 2 2. INTE-



2. INTEGERS.

ADDITION

TEACHETH to add fundry Numbers together into one Sum, called the Total.

RULE.

1. Place all the Numbers of a like Name under one another, that is, units under units, tens under tens, hundreds

under hundreds, &c.

2. Begin with the Units, and fingly collect the Sum of each Row, and if their Sum be less than ten, set it down underneath its own place; but if it exceeds ten, the Excess is only to be set down, carrying one for every ten to the next Row, and so on, continuing to the last Row, at which set down the total Amount.

PROOF.

Vary the adding, by beginning at the Top of the Sum, and reckon the Figures downwards, in the fame Manner you added them upwards, and if the Sum comes the fame as before, it is supposed to be right.

TABLE of ADDITION,

Which is to be got by Heart, by those who are Beginners in this Science.

0	I	2	3	4	5	6	.7.	8	9	The manner of using the Table is thus: Take the greater of the two
1	2	3	14	5	6	7	8,	9	10	thus: Take the
2		4	15	6	1 7	8	19	10	II	greater of the two
3	_	_	16	17	8	. 0	IO	II	12	Digits, whose Sum
4	_			8	9	10	II	12	13	is fought, in the
4 5	_				10	11	12	13	14	upper Line, and the leffer on the Left- hand Column, in
6	_			_ =		12	1,3	14	15	hand Column, in
7	_				-		14	15	16	the fame Line with
8	_						_	16	17	this, and under-
9	>			_=		=	<u>— :</u>		18	neath the other stands the Sum.

As suppose I wanted the Sum of 9 and 7, then I look for 9 on the Head of the Table, and in the same Line with 7 on the Side stands 16, the Sum.

EXAMPLES.

EXAMPLES.

one

noeds

of wn essente the ich

m, ner ne

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er

r

n

(1)	147279	(2) 176042	(3) 127492
	274042	47976	274614
	716914	274	27406
	472196	4	274
	417417	471472	24
	194746	469	4158
(4)	147747	(5) 2147426	(6) 174684
	74774	2749	147129
	2467	275	2984
	915	3746	100
	20	74	63
	6	2147	1074
(7)	174264 7416 271 147419 4176 47 7913 274	(8) 14768412 2131596 29418 274 71471041 219816 1427	(9) 174684 26276 174168 276 7 741705 27417 3570

3. SUBTRACTION

TEACHETH to take a leffer Number from a greater, and thereby shews the Difference or Remainder.

RULE.

- 1. Place your Numbers according to the Direction given in Addition.
- 2. Begin at the Right-hand, and subtract each under Figure, from that which stands over it, writing each Remainder

mainder under which it proceeds from, fo shall all the Re-

mainder together express the Difference required.

3. But when the under Figure exceeds that which stands over it, you must borrow ten (the same which you stopped at in Addition) from which take the lower Figure, and to that difference add the upper Figure and the Sum set down, always remembering to carry or add one to the next Figure on the Lest-hand, before you subtract.

PROOF.

To the leffer Number add the Remainder, if the Sum be like the greater the Work is right.

TABLE of SUBTRACTION.

0	I	2	3	4	5	6	7	8	9
						5			
2	-	0	1	2	13	4	5	6	17
						3			
			-	0	I	2	3	14	5
5	-	—	—	-	0	1	2	3	4
6	—	-	-		-	0	1	2	3
7	-	-		_	-	-	0	1	2
8	-	—	—	-	—	-	-	0	1
9	-	-	—	—	—	-	-	-	0

The manner of using this Table is the same with that of Addition, only, instead of adding the Digits together, subtract them.

EXAMPLES.

(1) From 1472742 Take 1251620	(2) 1704941 807467	(3) 17406542 16716746
Rem.	1 mily Lauddinas I	
Proof	teal (1 m) had y	3
(4) Bought 10768475 Sold 7607485	(5) 2074176 1760184	(6) 7417065 4708095
Rem.unfold	on entrology th	
OF HOUSE		estation of the

(7) From 107461. Take 17860	42 (8) 1246 76 914	8409 760 8	(9) 2170684 1100787
Rem.		9.0	
(10) From Take	106742740 74760946	(11)	214200040 107400760

4. MULTIPLICATION

TEACHETH how to increase any one Number by another, so often as there are Units in that Number by which the one is increased; and serves instead of many Additions.

To this Rule belong three principal Members, viz.

1. The Multiplicand, or Number to be increased or multiplied.

2. The Multiplier, or Number by which the Multiplicand

is increased or multiplied.

ds d to

it

3. The Product, or Number produced in multiplying.

Note.—Before any Operation can be performed in this Rule, it is absolutely necessary that the following Table be got by heart; as the ready Performance of this and all the following Rules, entirely depends upon having a perfect Knowledge of it.

				T	A	B 1	E			
1 2	3	4	5	6	7	8	9	10	11	12
24	6	8	10	12	14	16	18	20	22	24
3 -	9	12	15	18	21	24	27	30	33	1 36
4 -		16	20	24	28	32	36	40	44	48
5 -			25	30	35	40	45	50	55	60
6 -	3100	dit.	-	36	42	48	54	60	66	72
7 -		-			49	56	63	70	77	84
8 —		-				64	72	80	88	96
9	-	-					81	90	99	108
o -		-		Maria Car	-	a 1.3	AND DE	100	110	120
1	-		-	-		15			121	132
2 -		4	ALC: U	CE	177	TULF	-		-,56	144

USE of

Seek the greater of the tv underneath it against the Column, is the Product fou feek 9 in the upper Line, a is 54, the Product; and for

Note.-For the Conven have continued the Table to tion it is only required to 9

To multiply b

1. Place the Multiplier u Multiplicand. 2. Multiply the Units Fi

Multiplier, if their Produc under its own Place of Uni ten (or tens), then fet down and bear (or carry) the faid have multiplied the next Fig fame Figure of the Multipli for each ten borne in Mind, Sum above ten (or tens) a fame Manner until all the multiplied by the Multiplier

PR

The most fure and unerri the Learner is supposed not prove by it; let him there Multiplier, and if the Produ the Work is right.

Some Masters that teach of) Arithmetic, prove Mu this Method is not to be d a Sum to be right, when

But it will n utterly false.

Multiplication.

of the TABLE.

f the two Digits in the upper Line, and ft the leffer, taken in the Left-hand luck fought. Thus, to multiply 9 by 6, 1) N

3) 2

6) 7

W

I. s ov

> 2. plie

espe

y w

9) 1

12)

(3)

3. e th

P

Line, and under it against 6 on the left and fo of any other.

Table to 12 Times, or else in Multipli.

Conveniency of dividing by 11 or 12, I

ed to 9 Times. CASE

altiply by a Single Figure.

RULE.

riplier underneath the Units Place of the

Inits Figure of the Multiplicand by the

Product be less than ten, set it down of Units; but if their Product exceeds

et down the Excess only (as in Addition) he faid ten (or tens) in Mind, until you next Figure of the Multiplicand by the

Multiplier, and to their Product add one Mind, setting down the Excess of their tens) as before; and so proceed in the

all the Figures of the Multiplicand are ultiplier.

PROOF.

unerring Way is by Division: But as fed not yet to know that Rule, cannot n therefore make the Multiplicand the e Product comes out the fame as before,

t teach (and feveral Authors that write ve Multiplication by the Cross. But o be depended upon, as it will prove

when at the same Time the work is will not prove a Sum false that is right.

(18) 764258 417396 (19) 417396 764258 (20) 2719064 5648736

CASE III.

When Cyphers are intermixed with the Figures in the Multiplier.

RULE.

Omit them, and place the first Figure of each particular Product under its respective Multiplier.

E X A M P L E S.
(21) 10746047 (22) 804700625
40500108 207008009

C A S E IV.

When there are Cyphers at the Right-hand of either, or both the Multiplier and Multiplicand.

RULE.

Proceed as before, neglecting the Cyphers until the particular Products are added together, and to that Sum place the Number of Cyphers that are at the End of both Factors, on the Right-hand.

E X A M P L E S.
(23) 1460900 (24) 2768000
8700 24600

If it be required to multiply any Number by 10, 100, 1000, &c. it is only annexing the Cyphers of the Multiplier to the Right-hand of the Multiplicand, and the Work is done.

CASE V.

When the Multiplier is fuch a Number that any two Figures (in the Table), being multiplied together, will produce it.

RULE.

Multiply the given Number by one of those Figures, and that Product by the other, which will give the defired Product.

EX-

EXAMPLES.

- (25) Multiply 24674 by 16. (26) Mul. 340764 by 28.
- (27) Mul. 142395 by 56. (28) Mul. 176848 by 81.
- (29) Mul. 420746 by 72. (30) Mul. 17093 by 63.
- (31) Mul. 43074 by 144. (32) Mul. 14068 by 132.

CASE VI

When the Multiplier is any Number between 10 and 20.

RULE.

Multiply by the Figure in the Units Place, and as you multiply, add to the Product of each fingle Figure, that of the Multiplicand, which stands next on the Right-hand.

EXAMPLES.

- (33) 142716 (34) 14276 (35) 146094 (36) 24176 11 12 13 14
- (37) 36142 (38) 176424 (39) 14609 (40) 18627 15 16 17 18
- (41) 142768 19

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a. DIVISION

TEACHETH us to find how often one Number is contained in another, or to divide any Number or Quantity given, into any Parts affigned, and ferves instead of many Subtractions. In this Rule there are three Numbers real, and a fourth accidental, viz.

- 1. The Dividend, or Number to be divided.
- 2. The Divisor, or Number by which you divide.
- 3. The Quotient, or Number that shews how often the Divisor is contained in the Dividend.

4. The

4. The Remainder, which is always less than what you divide by.

CASE I.

When the Divisor is not greater than 12.

RULE.

First seek how often the Divisor is contained in the first Figure of the Dividend, or if in case the first Figure of the Dividend be less than the Divisor, then in the two first Figures of the Dividend, and set the Quotient Figure down accordingly, and, if any Thing remains, carry it to the next Figure in the Dividend, where it must be reckoned as so many Tens, that is, if one remains you call it 10; if two, 20; if five, 50; and so on, bearing in Mind the Remainder of each Figure, and adding it to the next, until you have made Use of all the Figures in the Dividend. This is called short Division.

PROOF.

Multiply the Quotient by the Divisor, and as you multiply, add the Remainder (if any), or add the whole Remainder to the Product at last, and if it comes the same as the Dividend, the Work is right.

E (1) 2)1742636.		M P L 3)2764064.	E	S. (3)	4)2160742.
(4) 5)1076426.	(5)	6)71420954.		(6)	7)4674263.
(7) 8)2768096.	(8)	9)6768094.	((9)	11)2762764.
(10) 12)276484.					

CASE II.

When the Divisor confists of many Places or Figures.

RULE.

RULE.

r. If the Divisor be a less Number than so many Figures taken in the Dividend, fee how often the first Figure of the Divisor is contained in the first Figure of the Dividend, and the Figure which expresses it is the first of the Quotient, by which multiply the Divisor, and place the Product under the faid Figures of the Dividend, and draw a Line underneath it; subtract it therefrom, and to the Remainder annex the following Figure of the Dividend, then proceeding as before.

2. But if it happen that the Divisor be a greater Number than fo many Figures of the Dividend, then you must take a Number of Places in the Dividend greater by one, and fee how often the first Figure in the Divisor is contained in the two first of the Dividend, Allowance being made for what you carry from the Figure on the Right.

3. If in any Cafe the Remainder be so small, that when the Figure of the Dividend, joined with it, make a Sum less than the Divisor, then a Cypher is to be placed in the Quotient,

and another Figure brought down, and then proceed as be-

fore; this is called Long Division.

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- 7489)1204530760((11)25)786473575((16)84)35730972((17) 42163)112737328((12)
- 648)272357640((18) 61746)392628787((13)
- (14) 759)30891829676((19) 684578)3233238699(
- (15) 3065)63463902247((20) 476085)98839054780((21) 4728395)27750950255(

CASE III:

When the Divisor has Cyphers on the Right-Hand.

R U.L.E.

Strike off to many of the lift Figures in the Dividend, and divide by those Figures of the Divisor that are left when the Cyphers are omitted. But when the Division is ended, those Cyphers so omitted in the Divisor, and the Figures cut off in the Dividend, are both to be restored to their own Places.

EX.

EXAMPLES.

(22) 2800)11928248((23) 172000)247004674(

When the Dividend has the same Number of o's on the Right-hand as the Divisor, strike them off from each, and the Remainder will be so many of what you divide by, without annexing the o's that were struck off.

(24) 473000)351858000((25) 6970000)599430000(

C A S E IV.

When the Divisor is such a Number, that any two Figures (in the Multiplication Table) being multiplied together, will produce the said Divisor.

RULE.

Divide the given Number by one of those Figures, and that Quotient again by the other, which will give the Quotient required.

Note.—Observe, That if there be a Remainder in the last Division, it will be so many Times the first Divisor, which added to the first Remainder (if any) will give the true one.

When the Learner is pretty well versed in Division, he may subtract each Figure of the Product, as he produces it, and so only write the Remainder, which will shorten the Work, and be much the best Way, (when the Divisor is small.)

E X A M P L E S.

(34) 17)690489((36) 467)2148686((35) 86)5343698((37) 6074)24939844(

TABLES of ENGLISH COINS.

Marked
q.
4 Farthings
are one Shilling.
20 Shillings
Pound, £.

The Cyplers are omigPl. But when the Division is ended, hold Cyplers to omen at its the Division the Figures out off in the Divident and paterw sites over the time out the Course of the Course out of the Course out t

PENCE

PENCE TABLE.

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d.		s.	d.	d.	d len	s.
20]		1	8	24]		2
30		2	6	36		3
40		3	4	48		4
50	174501	4	2	60		
60		5	0	72		5 6
70	are 4		10	84 }	are <	7 8
7º 8º		5	8	96	A. A.	8
90		7	6	108		9
100	0.117	8	4	120	2001	10
110	eligio 51	9	2	132		II
120	Linte	10	. 0	144	in mai	[12

The WEIGHTS and VALUE of fuch GOLD and SILVER COINS as are most commonly used in ENGLAND.

SOLING as are in	Weight			V	alue	e.
	dwts.gr.mit	es.		1.	s.	d.
A Guinea -	- 5 9 9	SECTION AND ADDRESS OF	-	1	I	0
Half ditto -	- 2 16 14		_	0	10	6
A Quarter ditt	o- i 8 7			0	5	3
first purch	SILV	E R.		e de la constante de la consta		
A Crown -	19 8 10	3 -		0	-5	0
Half ditto -	9 16 5	- 5	-	0	2	6
A Shilling -	- 3 20 18		-	0	1	0
A Sixpence -	1 22 9	LL <u>167</u>	'	0	0	6
Note.	-20 Mites ma	ke one	Grain	1.	1	

N. B. Besides the above Coins, we have had Portugal Money in use here, the Value and Weight of which are as sollows:

		s.			dwts.gr.
A Piece of —	3	12	0	should weigh	18 16
Ditto of —	1	16	0		9 6
Ditto of					4 15
Ditto of —	0	9	0		2 7
A Moidore -	1	7	0	r s	6 18
Half ditto	0	12	6	سے بنے اس	3 9
Quarter ditto	0	6	9	(<u> </u>	1 16±
			Č	2	A Pound

A Pound Weight Avoirdupoise of Copper, is coined into twenty-three Pence; consequently a Halfpenny is one third of an Ounce nearly, and a Farthing one fixth.

6. REDUCTION

TEACHETH to reduce all great Names into small, by multiplying the given Number with so many of the next lower Name, as to make one of the higher, still keeping them equivalent in Value, and is called Reduction descending; on the contrary, all small Names are brought into great, by dividing the given Number by so many of lesser Name as make one of the next greater; this is the Converse of the last, and is termed Reduction ascending.

EXAMPLES in MONEY.

- 1. In 271. how many Shillings and Pence?
 2. Reduce 6480d. to Shillings and Pounds.
- 3. How many Shillings, Pence, and Farthings, are there in 401. 10s.?
- 4. In 38880 Qrs. how many Pounds?
- 5. Reduce 1041. 17s. 6\frac{3}{4}d. to Farthings.
 6. How many Pounds in 100683 Qrs.?
- 7. In 21 Guineas, how many Shillings, Pence, and Farthings?
- 8. Reduce 21168 Farthings to Guineas.
 9. In 42 Moidores how many Farthings?
- 10. How many Moidores in 54432 Farthings?

WEIGHTS and MEASURES.

TROY WEIGHT.

Marked			
gr.	24 Grains		Penny Weight.
dwts.	24 Grains 20 Penny Weights 12 Ounces	are one	Ounce.
oz.	12 Ounces .		Pound. 15.

By Troy Weight is weighed Gold, Silver, Jewels, Amber, Bread, Corn, and all Liquors, and from this Weight all Measures from wet and dry Commodities are taken.

N. B. 14 oz. 11 dwts. 15 1 grs. Troy, is equal to 1 Pound

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EXAMPLE S.

1. In 24lb. of Silver, how many Ounces, Penny Weights, and Grains?

2. Reduce 138240 grs. to dwts. oz. and lb.

3. In an Ingot of Silver weighing 12 lb. 10 oz. 22 grs. how many Grains?

4. Reduce 73942 grs. to Pounds.

APOTHECARIES WEIGHTS.

Marked	1		
	20 Grains)	Scruple.
Š	3 Scruples		D
3	8 Drams	are one	Ounce.
3	12 Ounces	J	Pound, 16.

Apothecaries, in making up their Medicines, use this Weight, but they buy and fell their Drugs by the Avoirda poise Weight.

MPLES. X

5. In 14lb. how many Ounces, Drams, Scruples, and Grains?

6. Reduce 80640 grs. to 9, 3, 3, and 16.
7. How many Grains, 4 16, 11 3, 2 9, 17 grs.?

8. In 28377 grs. how many Pounds?

AVOIRDUPOISE WEIGHT.

Marked	desirate i		
dr.	16 Drams	1	Ounce.
oz.	16 Ounces		Pound.
lb.	28 Pounds	are one	Quart. of Cwt.
qr.	4 Quarters or 112lb.	4 1 4 4	Hundred.
cwt.	20 Hundred		Ton.
Settle 3	C a		Ву

By

By Avoirdupoife Weight is weighed all manner of Things that have Waste, as all Physical Drugs and Grocery, Rosin, Wax, Pitch, Tar, Tallow, Soap, Hemp, Flax, Hay, Wool, &c. all base Metal and Minerals, as Iron, Steel, Lead, Tin, Copper, Allum, Copperas, &c. Alfo Bread, Butter, Cheefe, Salt, Butcher's Meat, &c.

The Denominations in some of which are as follow, viz.

8 Pounds Stone of Butcher's Meat. Stone of Horseman's Weight. 14 Pounds are one { Fodder of Lead. 192 Hundreds.

WOOL WEIGHT.

7 Pounds } are one { Clove. 6½ Todds Stone. 2 Weys are one Wey. Sack. Todd. 12 Sacks J 2 Stones J Laft. HAY. Weight. BREAD.

1b. 0%. dr. 56 Pounds of old Hay, or \ are Peck Loaf 17 6 I 60 Pounds of new ditto) I Trufs. Half ditto 8 11 0 are I Load. || Quartern do. 4 36 Truffes

Note.—There are some Sorts of Silk which are weighed by a great Pound of 24 oz.

XAM P T. E S.

- 9. In 1 Ton, or 20 Cwt. how many Quarters, Pounds, Ounces, and Drams?
- 10. Reduce 573440 drs. to Hundreds, &c.
- 11. Reduce 27 lb. 12 oz. 11 drs. to Drams. 12. How many Pounds in 7115 drs.?
- 13. In 12 Tons, 10 cwt. 1416. 11 oz. 15 drs. how many drs.?

1.4. How many Tons are there in 7171775 drs.?

CLOTH MEASURE.

4 Nails	Quarter of a Yard	Marked.
		EH FY.
4. Quarters Sare one	Yard	Yd.
5 Quarters		Ell Eng.
6 Quarters)		Ell Fr.

Scotch

Scotch and Irish Linens are bought and sold by the Yard; but Dutch Linens are bought by the Ell Flemish, and sold by the Ell English.

EXAMPLES.

- 15. In a Piece of Cloth containing 24 Yards, how many Quarters and Nails?
- 16. Reduce 384 Nails to Yards.

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- 17. How many Nails are there in 72 Ells Eng. 4 grs. 2 na.?
- 18. Reduce 1458 Nails to Ells English.
- 10. In 121 Ells Flemish, how many Nails?
- 20. Reduce 1452 Nails to Ells Flemish.
- 21. How many Nails in 42 Ells Fr. 5 grs.?
- 22. Reduce 1028 Nails to Ells French.

LONG MEASURE.

Marked			
b. c.	3 Barley Corns) (Inch.
in.	12 Inches	i i	Foot.
f.	3 Feet or 36 Inches		Yard.
yd.	2 Yards or 6 Feet	i e	Fathom.
	5½ Yards or 11 half-yds.	> º 3	Pole, Rodor Perch.
p.	40 Poles or 220 Yards	are	Furlong.
fur.	8 Furlongs or 1760 yds.	14	Mile:
m.	3 Miles		League.
lea.	23 Leagues or 69 Miles		Degree, Deg.

360 Degrees are the Circumference of the Globe.

5 Feet is a Geometrical Pace. 16½ Feet is a Pole.

ALSO,

4 Inches
3 Hands Breadth are one Hand's Breadth.
Foot.
Cubit.

By this Measure, Distances of Places, or any Thing else, that has Length only, are measured.

EXAMPLES.

- 23. In 176 m. 30 p. how many Poles?
- 24. Reduce sogse Poles to Miles.

25. How

- 25. How many Yards, Feet and Inches, are there in 200 Miles?
- 26. In 12672000 Inches, how many Miles?
- 27. Reduce 12 Leag. 1 M. 6 Fur. 29 P. 4 Yds. to Barley Corns.
- 28. In 7193178 b. c. how many Leagues, &c.
 LAND MEASURE.

Marked				
	51 Yards		Perch, Rood,	or Pole.
p.	40 Poles		Rood.	
r.	4 Roods	are one	Acre.	
a.	30 Acres		Yard of Land.	
	100 Acres) (Hide of Land.	

The best Way of measuring Land, is by a Chain of 4 Poles, or 66 Feet long, which is divided into 100 equal Parts, called Links.

In.	b. c.	((ot 1)	raint, it is
	276	1	Pole.
25	Links		Pole.
4	Poles or 100 Links or 22 Yards	are one	Chain.
10	Chains	JY or o, ad	Furlong.

EXAMPLES.

- 29. In 42 Acres, how many Roods and Poles?
- 30. Reduce 6720 Poles to Acres.
- 31. In 12 A. 3 R. 29 P. how many Poles?
- 32. How many Acres in 2069 Perches?

WINE MEASURE.

	MILL TATION	O IC II.
Marked		
pts.	2 Pints	Quart.
qts.	4 Quarts or 8 Pints	Gallon.
gall.	10 Gallons	Anchorof Br.orR.
	18 Gallons	v Runlet.
	31 Gallons	Barrel.
3	42 Gallons	Tierce.
tier.	1 2 Tierce, or 84 Gallons	Puncheon, punch.
	63 Gallons	- Hogshead.
h.	2 Hogsheads or 126 Gal.	Pipe of Butt.
p.	2 Pipes or 252 Gal.	Tun.
1200		Note.

Note.—A Tun of Wine is 18 Cwt. Avoirdupoife.

A Gallon is 231 folid Inches.

By Wine Measure, all Spirits, Mead, Perry, Cyder, Vinegar, Oil, and Honey, &c. are measured; as also Milk, not by Law, but Custom only.

EXAMPLES.

33. In 4 Anchors of Brandy, how many Gallons and Quarts?

34. In 160 Quarts, how many Anchors?

200

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R.

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e.

- 35. Reduce 4 Hhds. of Wine to Gallons and Pints.
- 36. How many Hogsheads of Wine are in 2016 Pints?
- 37. Reduce 42 Tierces and 24 Gallons to Pints.

38. How many Tierces in 14304 Pints?

39. In 4 Tuns, 1 p. 1 hhd. 42 gal. 6 pts. how many Pints?

40. Reduce 9918 Pints to Tuns, &c.

WINCHESTER MEASURE.

Called also Ale and Beer Measure.

Marked	
pts.	2 Pints Quart.
qts.	4 Quarts or 8 Pints Gallon.
gal.	Pints Quarts or 8 Pints Gallons Ale, or Gallons Beer Firkins Gal. Guart. Gallon. Gallon. Kilderkin.
fir.	2 Firkins Gal. (Kilderkin.
kil.	2 Kilderkins, or or 32 Ale are 1 Barrel.
bar.	Gal. (Kilderkin. Kilderkins, or or { 32 Ale 36 Beer } are 1 Barrel. Firkins or { 48 Ale 36 Beer } are 1 Hogshead.
hhds.	2 Hogsheadsor 3 Bar. or 108 Gal. are one Butt. 2 Butts or 216 Gallons are one
	2 Butts or 216 Gallons 3 ale one Tun.
Note.	8 Gallons is a Firkin of Beer or Ale, in all Parts

Note.—8½ Gallons is a Firkin of Beer or Ale, in all Parts of England, except London.

A Gallon of Ale or Beer, is 282 folid Inches.

A Firkin of Soap or Herrings is the same with that of Ale.

EXAMPLES

41. In 12 Barrels of Ale, how many Gallons and Quarts?

42. Reduce 1536 Quarts of Ale to Barrels.

43. In

43. In 42 Barrels of Beer, how many Pints?

44. Reduce 12096 Pints of Beer to Barrels.

45. In 6 hhds. 27 gal. 6 pts. of Ale, how many pts.?

46. How many hhds. of Ale in 2526 pts.?

47. How many gal. and pts. in 14 hhds. 47 gal. of Beer?

48. Reduce 6424 Pints of Beer to Hogsheads.

49. Reduce 6 Tuns, 1 Butt, 42 Gal. of Beer to Quarts.

50. How many Tuns, &c. in 5784 Quarts of Beer?

DRY MEASURE.

Marked		All the state of	
pts.	2 Pints	Assista II	Quart.
qts.	4 Quarts or 8 Pints	en conter?	Gallon.
	2 Gallons	- 135th 1	Peck.
pks.	4 Pecks or 8 Gallons	are one	Bushel.
bu.	4 Bushels	Pare one	Comb.
c.	2 Combs or 8 Bushels		Quarter.
qrs.	5 Quarters		Wey.
	2 Weys or 10 Quarters-		Laft.
		_	as all

A L S O,
4 Quarters or 32 bu. are one Chaldron Strike of Corn

A Load of Corn is 5 Bushels. A Cart Load of ditto is 40 Bushels.

2 Quarts are one Pottle, both in Liquid and Dry Measure.

A Gallon contains 268\$ folid Inches.

In measuring Sea Coal,

5 Pecks is one Bushel, Water Measure.

3 Bushels 3 Sack. Vatt.

36 Bushels, or are one Chaldron.

21 Chaldrons J Score.

By Dry Meafure, Corn, Salt, Coals, and all other Dry Goods are meafured.

The standard Bushel is 18 Inches wide, and 8 Inches deep.

EXAMPLES.

51. In 24 Quarters of Gorn, how many Bushels, Pecks, Gallons, and Quarts?

52. How

52. How many Quarters of Corn in 6144 qts.?

3. Reduce 36 chs. 26 bu. of Coals to Pecks.

54. How many Chaldrons of Coals in 5288 Pecks?

55. In 64 Lasts of Corn, how many Weys, bu. and Pecks?

56. How many Lasts in 20480 Pecks?

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TIME.

Time of itself is nothing, but from Thought Receives its Rise, by labouring Fancy wrought; From things consider'd whilst we think on some, As present, some as past, or yet to come: No Thought can think on Time, that's still confess'd, But thinks on Things, in Motion or at Rest.

Marked			24.002
111	60 Thirds		Second.
fec.	60 Seconds	ST.	Minute.
m.	60 Minutes	-,-	Hour.
h.	24 Hours	ne	Day.
d.	7 Days	0	Week.
w.	4 Weeks, or 28 Days	are	Month.
*•	52 Weeks, 1 Day, 6 Hours, or		
mo.	13 Months, 1 Day, 6 Hours, or		Year Julian.
	365 Days, 6 Hours	A	
	이 바다 아들이 가게 있는데 이 마이에 가지면 가게 되었다. 그런데 보고 있는데 이 이 사람이 있다고 말이 하지 않다.	100	

365 Days, 5 Hours, 48 Minutes, 57 Seconds, 39 Thirds, are a Solar Year.

The Year is also divided in 12 unequal Calendar Months, called,

January, February, March, April, May, June, July, August, September, October, November, December.

And to know how many days are in each Month, observe (to get by heart) the following Lines:

Thirty Days hath September,
April, June, and November;
February hath twenty-eight alone,
And all the rest hath thirty-one;
Except Leap-year, and then's the Time,
February's Days are twenty-nine.

EXAMPLES.

272 Solid Luche:

EXAMPLES.

- 57. How many Hours, Minutes, and Seconds, are there in a Week, or 7 Days?
- 58. In 604800 Seconds, how many Days?

59. Reduce 6 mo. 4 d. to fec.

60. In 14860800 fec. how many Months?

61. How many Seconds are there in a Julian Year, or in 365 Days, 6 Hours?

62. In 31557600 fec. how many Days?

63. How many Thirds are there in a Solar Year, or in 365 Days, 5 Hours, 48 Minutes, 57 Seconds, and 39 Thirds? 64. Reduce 1893416259 Thirds to Days.

SQUARE or SUPERFICIAL MEASURE.

	Square]	Square Foot.
304		Yards		Pole.
40		Roods	are one	Rood.
640 4840		Acres or \	alad Sons เพราะกิน	Mile.

2724 Feet is one Rod of Brick Work.

100 Square Feet is one Square of Flooring.

By this Meafure are measured all Things in which Length and Breadth is only confidered.

EXAMPLES.

65. In 42 Square Yards, how many Square Inches?
66. How many Square Yards in 54432 Square Inches?
67. Reduce 3 fq. 42 Feet, 64 in. of Flooring to Inches.
68. How many Squares are there in 44312 fq. Inches?

CUBIC or SOLID MEASURE.

1728 Solid	Inches	Solid Foot.
27 —	Feet	Solid Foot. — Yard.
40 -	Feet of round Timber, or 1 (T
50 -	Feet of round Timber, or }	(Tonor Load.
	Sodid Yard of Earth is called a L	

A Solid Yard of Earth is called a Load.

108 Solid Feet (i. e.) 12 Feet long, 3 Feet broad, and 3 Feet deep, or commonly 14 Feet long, 3 Feet 1 Inch broad, and 3 Feet 1 Inch deep, is a Stack of Wood; 128 folid Feet, (i. e.) 8 Feet long, 4 Feet broad, and 4 deep, is a Cord of Wood.

By this Measure are measured all Things, in which are

confidered Length, Breadth, and Depth or Thickness.

EXAMPLES.

69. In 27 folid Yards, how many folid Inches?

70. Reduce 1259712 folid Inches, to folid Yards?

71. How many folid Inches are there in 4 Tons 24 Feet of hewn Timber?

72. In 387072 folid Inches, how many Tons of hewn Timber?

Of fome particular WARES or GOODS.

12 Dozen
12 Grofs
20
5 Score
6 Score, or 120
1200

END OF BOOK I.

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TUTOR'S GUIDE.

BOOK II.

EXERCISE in NUMERATION.

TN Figures express the following Number, viz.

1. One Million and a half in South Sea Bonds.

2. Threefcore and twelve Thousand thirteen Hundred Weight of Lead.

3. Fifteen Thousand and fourscore Million of Stivers.

4. One Hundred and twenty Thousand two Hundred and fixty Millions seventy Thousand seven Hundred and seven Rials of Plate.

5. Three Million and thirty-three Thousand and thirty Pieces of Eight.

6. Four Hundred Thousand and forty Hundred Pounds, thirty-four Shillings, and fourteen Pence five Farthings.

ADDITION.

EXAMPLES of INTEGERS.

1. Add the following Numbers, viz. 140724, 296, 42, 6740, 64167, 20, 2687, and 2684 together.

2. Add 27460, 176, 2900, 274, 1004, 64, 596, 41, and 6104 together.

3. Add 867, 317, 69, 1720, 276842, 49, 426074, and 60 together.

7. COM-

7. COMPOUND ADDITION

TEACHETH to add fundry Sums or Numbers together, having divers Denominations, as in Money, Weights, Measures, &c.

RULE.

1. Place the Numbers of a like Denomination under each other, viz. Pounds under Pounds, Shillings under Shillings,

Pence under Pence, Farthings under Farthings, &c.

2. Begin to add, at the lowest Denomination first, as in Integers, then divide that Sum by as many of the same Denomination as make one of the next greater, setting down the Remainder under the Row added, and carry the Quotient to the next superior or greater Denomination, whose Sum you must also find; proceed in this Manner to the last (or greatest Denomination), which add as Integers.

EXAMPLES of MONEY.

£.	s.	d.	IL.	s.	d.		£.	s.	d.
(1) 4	17	114 4	(#) £.	TI.	6	(3)	127	II	102
2	6	4	27	16	111		41	17	6
1	19	103	47	17	7		100	0	0
3	11	103 6± 9 2	56	6	44		52	10	113
8	17	9 2	17	11	112		116	12	6
		0	47	6	4		24	19	112
6	0	1134	. 0	10	6		6	6	0
	1 1 2 11	6	. 4	0	0		0	10	6
2	8	114.4	17	17	$6\frac{3}{4}$		2	2	0
	_								-

⁽⁴⁾ Add 270l. 16s. $6\frac{1}{2}d$. 6ol. $10\frac{1}{4}d$. 6ol. 10s. $\frac{3}{4}d$. 96l. 6s. 10d. 176l. 6s. $6\frac{1}{2}d$. 2l. 2s. 16l. 17s. $6\frac{1}{2}d$. and 10ol. into one Sum.

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⁽⁵⁾ Add 260l. 17s. 67l. 10s. $10\frac{3}{4}d$. 170l. 10s. $\frac{1}{2}d$. 100l. 10s. $6\frac{1}{4}d$. 4l. 16s. $6\frac{1}{2}d$. 19s. $\frac{3}{4}d$. 37l. 11s. $11\frac{1}{2}d$. 600l. 10s. and 220l. $6\frac{1}{2}d$. into one Sum.

⁽⁶⁾ Add 276l. 17s. 16l. $10\frac{1}{4}d$. 26gl. 11s. $11\frac{1}{2}d$. 107l. 19s. 10l. 6d. 14s. 11d. 367l. 17s. $6\frac{3}{4}d$. 12s. $4\frac{1}{2}d$. 20l. 10s. 6d. and 1000l. into one Sum.

Of WEIGHTS and MEASURE.

	02.0	læts.gr	5.		15.	oz.d	wts.	grs.		3 7	Э.	grs.
(1)	27	11.2	0	(2)	27	10	17	11	(3) 1	2	1	17
		14 2			11	11	19	6		7 4		
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	11				(5) 14			
II	2	I	1	17	417	II	1	21
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16.		oz.	drs.	yds.	grs.	na.	Eng. Ells	grs.	s.na.		
			14	(7) 14			(8) 12				
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	21	4	15	4	I	I	176	3	2		
21	36	13	11	110	0	0	94	1	3		
	14	7	10	17	3	2	62	2	1		
	6	II	6	13	2	3	142	1	2		
	4	4	12	106	1	2	41	2	3		

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42	1	2	27	1	4	27	27	I	4	1	
146	2	1	141	2	6	36	214	2	10	2	
64	I	3	84	0	7	39	76	0	II	0	
72	2	I	100	1	4	11	217	2	4	2	
87	1	2	36	2	5	13	96	1	II	I	
100	0	0	- 4	0	0	24	140	2	0	0	
43	2	3	120	2	6	6	60	0	10	1	

A. r. p.	tuns.p.hds.ga.qts.	punch.gal.qt.pt.
(12) 210 2 27	(13) 12 1 1 14 2	(14) 14 14 2 I
74 3 14	14 1 1 27 3	7 3 ² 8 I
142 1 37	10 1 0 61 1	24 51 2 1
47 2 14	6 1 1 42 2	14 14 1 1
149 0 27	200263	49 36 3 T
34 3 36	13 1 1 4 2	37 17 1 1
8 1 11	600363	8 62 3 1
tier. gal. pts.	anch. gal. pts.	A.hhds.gal.qts.
(15) 12 24 7	(16) 10 7 4	(17) 14 12 2
41 41 4	14 9 7	6 41 3
3 26 2	27 4 2	17 27 I
0 14 5	460	8 34 2
27 39 6	11 5 3	47 40 3
19 14 4	2 3 5	4 27 I
21 34 3	17 2 6	18 11 0
B.hhds.gal.pts.	A.bar.kil.fir.ga.pt.	B.fir.gal.qts.pts.
(18) 24 51 7	(19) 14 1 1 4 7	(20) 14 & 2 I
14 17 4	27 1 0 7 4	9710
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142 6 1 1	6 31 3	7 1 3 4 2
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	12	1	0	23		170	10	14	27
	31	2	5	0		64	17	56	19
	14	I	1	II		210	23	0	46
	6	3	6	17			4		
	8	2	1	20		4	19	59	42
									1 40 8 6

APPLICATION.

1. HOW many Days are there from June 1, to Jan. 27, following?

2. Suppose a Man to be born in the Year of our Lord 1772,

in what Year will he be 60 Years of Age?

3. A Gentleman left his eldest Daughter one Thousand Pounds more than the youngest, whose Fortune was eleven Thousand eleven Hundred and eleven; what was the eldest Daughter's Fortune, and what did the Father leave them?

4. In the Biffextile, or Leap Year, how many Days in each

Month, and what is their Sum?

5. A. owes fuch a Sum of Money, that if he paid feventeen Pounds feventeen Shillings and Sixpence, the Remainder to pay will be eighty-two Pounds two Shillings and Sixpence; required the Sum owed?

6. A Privateer took a Prize, the private Men's Share came to 4741. 175. 11½d. and the Officers received as much, befides 4671. unknown to the private Men; how much

did the Officers receive?

7. A Nobleman, going out of Town, is informed by his Steward that his Corn Chandler's Bill comes to 123l. 19s. His Brewer's to 41l. 10s. His Butcher's 212l. 6d. To his Lordship's Baker is owing 24l. To his Tallow-Chandler 13l. 8s. To his Taylor 137l. 9s. 9d. To his Draper 74l. 13s. 6d. His Coach-Maker's Demand was 214l. 16s. 6d. His Wine-Merchant's 68l. 12s. His Confectioner's 16l. 2s. His Rent 82 Guineas, and his Servants Wages, for Half a Year, came to 46l. 1s. What Money must be send to his Banker for, in Case

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Case he would carry with him 501. to destray his Ex-

pence on the Road?

8. A Corn-factor buys feventy Quarters of Oats, for 46l.

7s. 6d. thirty-eight Quarters of Beans, for 100l. twelve Quarters of Peafe, which cost 16l. 16s. eighty-eight Quarters of Barley, for 73l. 8d. fixteen do. of Wheat, for 56l. 9s. 10d. and fix Quarters of Rye, for 4l. 4s. 6d.

The Water carriage of all comes to 13l. 2s. 7d. his riding Charges to 1l. 13s. and if he clears eighteen Guineas by the Bargain, what do his Bills of Parcels amount to?

9. A Collector of Cash has been out with Bills, and gives an Account that A. paid him 13l. and Half a Crown; B. 2l. 13s. C. 14s. and a Groat. D. 1l. 9s. $8\frac{1}{2}d$. E. 11l. $6\frac{1}{4}d$. F. 17s. and a Tester. G. 12s. 6d. H. a Pound, and Half a Guinea. I. a Moidore, and 13s. K. two broad Pieces of 23s. each, a Jacobus of 25s. and a Shilling. L. nine Pounds and a Mark. M. 12l. 12s. N. a Bank Note of 15l. and O. three Crown Pieces and an Angel: what Cash had he in Charge?

Wares, as per Factor, 4181. 2s. 6d. for forty Cwt. of Cheshire Cheese, 521. 18s. for English Broad-cloath, fifteen Pieces, 3171. 12s. 10d. for 19 Fodder of Lead, 3201. for 12 Tons of Bar-iron, 1731. 3d. for eight Tons of Copper, 11101. 10s. 1d. for his Acceptance of a Bill drawn, 881. 14s. for another paid for Honour, 501. ten Dozen of Morocco Skins, 281. 15s. 4d. paid Convoys, Insurance, and Port Charges, 431. Warehouse Room, Postage, Sledage, Boatage, and incidental Charges, 51. 5s. The Factorage of all came to 1121. 6s. For what Sum must B. draw to clear the Account?

Difhes, weighing 193 oz. 6 dwts. Plates thirty-fix, weighing 421 oz. 11 dwts. four Dozen of Spoons, weighing 104 ounces, 6 dwts. fix Salts chafed, weighing 32 oz. Knives and Forks, weighing 83 oz. 9 dwts. four Prefenters weighing 113 oz. 4 dwts. in Mugs, Tumblers, Beakers, and other odd Pieces, wt. 264 oz. 18 dwts. A Silver Tea-Kettle and Lamp, weighing 126 oz. 9 dwts. and the Rest of that Equipage 93 oz. 2 dwts What Quantity of Plate had the Butler under his Care?

12. A Mer-

of which weighed 2 cwt. 2 qr. 10 lb. No. 2. 2 cwt. 1 qr. 16 lb. No. 3. 2 cwt. 24 lb. No. 4. 1 qr. 16 lb. besides a couple of Pockets of ditto, that weighed 58½ lb. each. How many Hundred Weight has he to pay Carriage for, on bringing them to Town?

13. A Gentleman at A. defired to know how far it was to E. and had the following Answer, viz. from hence to B. is 39 m. 6 fur. thence to C. is 46 m. 24 p. then to D. 60 m. 4 fur. 39 p. and thence to E. 37 m. 6 fur. What

is the Distance from A. to E.?

14. A Father was 28 Years old, (reckoning 13 Months to 1 Year, and 28 Days to 1 Month) when his eldest Child was born, betwixt the eldest and second were 2 Years, 10 Months, and 16 Days; betwixt the second and third were 1 Year, 11 Months; betwixt the third and sourth were 3 Years, 7 Months, 2 Days, when the sourth is 16 Years, 9 Months, 27 Days. How old is the Father? QUESTIONS for Exercise at leisure Hours.

15. How much is A. (born 16 Years ago) older than B. who will come into the World 14 Years hence?

16. A Person was 17 Years of Age 29 Years since, and he will be drowned 33 Years hence: Pray in what Year of

his Age will this happen?

17. A Person said he had 20 Children, and that it happened there was a Year and a Half between each of their Ages, his eldest was born when he was 24 Years old, and the Age of the youngest is now twenty-one; what was the

Father's Age?

18. A Sheep-fold was robbed three Nights successively, the first Night half the Sheep were stolen and half a Sheep more; the second Night half the Remainder were lost, and half a Sheep more; the last Night they took half what were lest, and half a Sheep more; by which Time they were reduced to twenty; how many were there at first?

19. Find how many Years it was from the Oreation of Adam to the universal Deluge in the Days of Noah, called Noah's Flood; by the 5th Chapter, and 6th Verse of

the 7th Chapter of Genefis.

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SUBTRACTION.

EXAMPLES of INTEGERS.

(1) From 476004 take 120706. (2) From 276000 take 106019. (3) From 40106 take 27109.

8. COMPOUND SUBTRACTION

Teacheth to find the Difference between any two Sums of divers Denominations, as Money, Weights, Measures, &c.

RULE.

Subtract as in Integers, only when the under Number of any Denomination is greater than that which stands over it; borrow so many of that Denomination as make one of the next Superior, from which take the under Number, and to the Remainder add the upper Number, which sum set down, remembering to carry or add one to the next higher Denomination, before you subtract.

EXAMPLES of MONEY.

(1) From Take 1	42	s. 17 4	$II\frac{I}{2}$		l. 210 176	10	
Remains	1.74						
(3) Borrowed 2 Paid 1	64	\$. 0 12	0	(4)	l. 153 7 6	s. 14 0	d. 6½ 034
Rem.unpaid			-				
	l. 47	s. 6 16	01		l. 300 196	10	
Rem.unpaid							
					В	orro	owed

Subtraction.

Fi T R

F T R

B So R

F T R

F T R

Fi T

Borrowed 476 o o	Lent 1476 14 6
41 17 6 Faid at fun (4) At 12 10 11 89 18 4 17 10 16 12 6	Rec. at fundary dry Times. 44 18 0 6 14 19 6 6 18 0 6 19
Paid in all	Received in all
Rem. unp.	Rem. unp.
Borrowed 214 16 4½ 176 11 11¼ 2 647 16 4½ 84 12 0½ 317 16 10½ 317 16 10½ 176 15 4 500 0 0 147 17 6 374 13 11	Paid 142 14 6 176 17 1134 21 67 19 6 476 0 0 147 10 10 477 10 10 477 18 8 100 0 0 427 18 114 176 6 4
Bor. in all Paid Rem. unp.	Paid in all
	- ACTIONO
(1) lb. oz. dwts.grs. Bought 14 10 12 17 Sold 11 11 14 21 Rem. unf.	and MEASURES. (2) (3) 0z.dwts.grs. 16 10 21 12 17 14 14 10 6 2 17
Tons. C. qrs. lb. From 14 11 2 17 Take 12 11 2 24 Remains	(5) (6) lb. oz. dwts. yds. qrs. na. 140 10 14 141 2 3 137 14 15 74 3 2

	(8) Fl.ell. gr. na. L	(9)
From 120 4 2		ea. m. fur. pa. 20 1 4 24
	69 2 3	80 2 7 37
Rem.		
(10)	(11)	
From 148 2 10 2	A. r. p. Tons.	사진 하다는 사람들이 가다는 것이 하나 없다.
Take 97 2 11 2	178 2 24 11	1 1 41 7
Rem.	·	
(13)	(14)	(15)
Punch.gal.qts.pt		Anch.gal.pts.
Bought 14 64 2		
Sold 10 72 3	1 12 41 7	17 7 7
Rem. unf.		
(16)	(17)	(18)
A.hhd.gal.qts.	B.hhd.gal.pts.	B.fir.gal.pts.
From 24 41 2	12 46 4	14 4 4
Take 17 47 3	10 51 7	10 8 6
Rem.		
(19)	* (20)	(21)
A.ba. fir. gal.qts. 1		
From 42 2 4 2		21 24 0
Take 14 3 7 2	1 6 7 3	14 34 2
Rem.		
(22)	(23)	(24)
La. w. q. b. p.	Mo.w.d. h.	D. h. m. fec.
From 12 1 4 4 2	14 2 4 21	264 14 24 41
Take 8 0 4 7 3	11 2 6 22	107 21 41 56
Rem.	41.2	
		APPLI-

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APPLICATION.

1. Suppose a Person was born in the Year of our Lord seventeen Hundred and thirty-sive, how old is he this present Year being 1784?

2. There are two Numbers, the greater is 102, and the leffer 72, what is their Difference and Sum?

3. A. and B. having each a Sum of Money, A.'s Sum, which is the greatest, is 741. 175. and the Difference of their Sums is 491. 135. 6d. I demand B's Sum?

4. Suppose I borrow 1001. and pay in Part 411. 175. 6d. how much remains to pay?

5. Suppose a Gentleman has an Estate of 600l. per Annum, and he pays Land-Tax 140l. also for Repairs 94l. 17s. 6d. what is his neat Estate per Annum?

6. A Person dying left 131111. 10s. 6d. between his Son and Daughter; the Daughter was to have eleven Thousand, eleven Hundred and eleven Pounds, what was the Son's Fortune?

7. A Horse in his Furniture is worth 351. 101. out of it 121.
121. how much does the Price of the Furniture exceed that of the Horse?

8. A Trader failing was indebted to A. 71l. 12s. 6d. To B. 34l. 9s. 9d. To C. 16l. 8s. 8d. To D. 44l. To E. 66l. 7s. 6d. To F. 11l. 2s. 3d. To G. 19l. 19s. And to H. a Fine of go Marks. At the Time of this Disafter he had by him in Cash 3l. 13s. 6d. in Commodities he had 23l. 10s. in Houshold Furniture 13l. 8s. 6d. in Plate 7l. 18s. 5d. in a Tenement 56l. 15s. in recoverable Book Debts 87l. 13s. 10d. Supposing these Things faithfully surrendered to his Creditors, what will they then lose by him?

9. A. made a Bond for 1141. 10s. the Interest came to 191. He then paid off 40 Guineas, and gave a fresh Bond for what was behind. By the Time there was 131. 4s. 8d. due on the second for Interest, he paid off 371. 14s. 2d. more; took up the old Bond, and signed a new one still for the Residue; the Principal again run on till there was 91. 11s. 3d. more due, and then he determined to take it up; pray what Money had his Creditor to receive?

10. A Chaife, Horse, and Harness, were altogether valued at 501. the Horse in Harness was worth 381. 16s. 6d.

the Chaise and Harness were estimated at 13 Guineas;

their feveral Valuations are required?

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11. Received in Lieu of two Gold Repeaters, fent to Jamaica in 1782, the five Chefts of Indigo following; and on a like Adventure in 1784, the subsequent five Chefts. The Question is, how much Indigo I had less the second Time than the first?

					IC IIII						
Anno	1782.	cwt.	qr.	lb.		Ib. A	1. 1784.	cwt.	qrs.	lb.	lb.
					Tare						Tare 32
	2.	2	2	II		47		1	3	17	32
	3.	2	0	12		41		1	2	10	30
1 1 1 1 10	4.	2	0	19		42		1.	0	13	27
	5.	2	3	17		49		.2	0	11	34

12. A, B, and C, open an Account with a Banker, Jan. 11, 1784, and put into his Hands, viz. A. 17 Guineas, B. 341. 115. 6d. C. 281. 185. 10d. On the 21st, A. withdrew 91. 105. and C. advanced 121. and a Crown. The 24th, B. called for 61. 105. The 30th, C. wanted 191. 85. 4d. On the 12th of Feb. B. deposited with him eleven Carolus's, each 235. and 3 Moidores. On the 19th, A. sent for 51. and a Noble more; but on the 24th returned him 421. On the 2d of March, C. paid in twenty Guineas, and B. drew for six. The 14th B. sent in 171. 85. 8d. and the 17th A. had back 121. 25. 6d. On the 19th they sent for sive Guineas a Man, and on the 24th they returned that Sum, and ten Marks a piece more: How much did their said Banker owe them jointly and separately at Lady-Day?

13. A Merchant taking an Inventory of his Capital, finds in his Vaults 28 Puncheons of Brandy, which cost him 8741. 105. 6d. Bourdeaux Claret, 40 Tuns, which stood him in 7541. 4s. 22 Lasts 4 Bushels of Corn, in his Granary, worth 6751. 175. 3d. with 2 Lasts of Canary Seed worth 1131. In his Warehouse were ten Casks of Indigo, worth 6321. 125. A Parcel of Saffron, worth 2531. 5s. W. P. of Stafford owed him 3841. 10s. In the Hands of F. G. at Lynn, he had Wines to the Amount of 10111. 10s. Pepper in the keeping of S. Q. of the Custom-house, Value 12521. 16s. 8d. besides which R. O. owes him on Bond 3001. and T. M. on Note 2601. 14s. He has in India Bonds to the Value of 4591. and

the Interest of those Securities made 251. 14s. 6d. He had Bank-Stock to the Value 2134l. 4s. 6d. There lay in his Banker's Hands 1892l. 17s. 6d. He was at this Time indebted to D. E. 713l. 13s. To M. F. 352l. 10s. 8d. to L. P. the Foot of his Account, 172 Guineas. To J. B. on Balance 57l. 12s. 10d. To an Insurance 190l. The present State of this Person's Fortune is required?

14. A Merchant at his out-fetting in Trade owed 2801. He had in Cash, Commodities, the Stocks, and good Debts, 115051. 103. He cleared the first Year by Commerce 3931. 133. 1d. What was his neat Balance at the Year's End?

15. Received from my Factor at Alicant, on Account of Sales of Tin, to the Value of 1971. 12s. Sterling; of Bees-Wax to 71l. 7s. 6d. of Stockings to 47l. 3s. 6d. of Tobacco, the net Proceeds whereof were 943l. 15s. 10d. of Cotton 123l. 3s. 7d. and of Wheat to the Amount of 116l. 5s. 6d. He at the fame Time advises, that he has, per Order, shipped, for my Account and Risk, Alicant Wines to the Value of 226l. 16s. 6d. Figs, 15ol. 11s. 3d. Fruit, 90 Chests cost 104l. 6s. Olives, 136l. 10s. Oil, 193l. 17s. Raisins, 143l. 4d. and Spanish Wool to the Value of 75l. 13s. 8d. The Commission of the whole Consignment came to 71l. 18s. 11d. The Question is, which of us is to draw for the Difference, and how much?

16. Jacob by Contract was to ferve Laban for his two Daughters 14 Years; and when he had accomplished 11 Years, 11 Months, 11 Weeks, 11 Days, 11 Hours, and 11 Minutes: Pray how long had he to ferve?

17. W. X. Y. and Z. fend their Money to the Bank, and draw upon it in the following Manner, viz. June 4, 1784, Z. fent in 701. 8s. Y. had 1161. 14s. 10d. remaining on Balance, and the 14th fent in 1201. more. W. paid in 471. 18s. 2d. in Cash, and delivered a Bank Note for 2001. X. paid in a Bill of Exchange, on a good Man, for 331. 14s. 9d. and in Cash made it up 1001. Y. on the 16th drew for 431. 12s. 6d. and the 20th Z. for eleven Guineas. W. on the 24th added 141. 12s. 1d. and X. withdrew 471. 10s. 8d. Y. on the 28th paid in 181. 5s. and two Days after drew for 881. 13s. 4d. W. sent for 63 Guineas on the 30th, and in five Days after for 151. 10s. 9d. more. Z. on the 7th of July, demanded

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manded 121. 8s. 3d. and X. 7l. 3s. 1d. Z. on the 15th, remitted them 31l. 12s. 4d. and per Assignment, they received for him at the same Time double that Sum. Y. required 81l. 19s. 8d. on the 12th, and W. ten Guineas. Y. three Days after that sent in 42l. and W. 52l. On the 19th X. sent for 38l. 18s. 10d. and the 24th paid in 19 Guineas. The Question is, how stood these Gentlemen's Cash severally, and what Money can they jointly raise? QUESTIONS for Exercise at Leisure Hours.

18. Having a Piece of Ground 127 Feet in Front, let off to A. 57 Feet, to build on at 1 End; and to B at first 27½ Feet, which he afterwards, by Consent, extended to 42 Feet: What Ground was left me in the Centre?

19. If I am 42 Years older than you now, what will be the Difference of our Ages 14 Years after my Decease, in case you should then survive?

20. Of the noble Family of Cornaro, the Grandsire's Age was 134 Years, and he was 93 Years older than the Son, at the Time when the Son and Father's Ages together made 112 Years; distinguish their Ages.

21. B. was 14 Years old when C. was 25; how old shall C. be when B. comes to be 25?

22. What is the Difference between the Ages of A. born in the Year 1693, and B. that will be born 13 Years hence, the Question being put in the Year 1779?

When the Air presses with its full weight, in very fair Weather, it may be demonstrated, that there presses upon a human Body about 33905 Pounds of that sluid Matter; and in foul Weather, when the Air is most light, but 30624 Pounds. What Difference of Weight lies on such a Body, in the two greatest Alterations of the Weather?

24. Hipparchus and Archimedes of Syracuse, about 200 Years before Christ, Posidonius 50 Years before the said grand Period, and Ptolemy 140 Years after it, all advanced the Science of Astronomy: How long did each of these Persons flourish before the Year of Christ, 1784?

25. In the City of Pekin in China is a Bell, weighing, it is faid, 120000lb. at Nankin, in the fame Country, is another weighing 50000lb. The first exceeds the great Bell at Erfurd, in Upper Saxony, by 94600lb. How much E 2

then is the German Bell inferior in Weight to the Second?

26. Your Grandfather, if living, is 119 Years of Age, your Father actually 65; you are not so old as your Grandfire by 83 Years: What is the Difference in Years between your Father and you?

27. A Snail in getting up a May-pole, only 20 Feet high, was observed to climb eight Feet every Day; but every Night it came down again four Feet. In what Time by

this Method did he reach the Top of the Pole?

28. A. is 13 Years younger than B. and 17 Years older than C. who in the Year 1747 was known to be 24 Years of Age: How old was each of these Persons in 1784?

29. A public Edifice was finished towards the Close of the noth of King John, who began his Reign 134 Years after the Conquest in 1066; and it stood till within 70 Years of the Peace of Utrecht, in 1713; of what Duration was it?

30. A Grant was made by the Crown, Anno 1239, which was forfeited 137 Years before the Revolution in 1688;

how long did the same subsist?

31. Moses was born Anno Mundi 2433; Homer 832 Years after him; Julius Cæsar lived 40 Years before our Saviour, and Alexander 312 Years before Cæsar; now as Christ was incarnate 4000 Years after the Creation, the Sum of the Intervals between Homer and the three

great Personages last mentioned is required?

32. The Semi-diameter of the Earth's Orbit, or annual Path round the Sun, in the Centre of the System, is about 81,000,000 of Miles, that of Venus 59,000,000; when they are both on the same Side the Sun, they are in Perigæo; when on different Sides, in Apogæo: What is the Difference of their Distances in both these Circumstances?

33. B. was born 14 Years after C. who came into the World
19 Years before A. who was 23 Years of Age eight
Years ago: What then is the Age of D. who is within
22 Years of being as old as those three together?

34. Arphaxad was born to Shem two Years after the Deluge, and 500 before his Father's Death; but at 35 Years of Age he had Selah, who at 30 was Father to Eber; who

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at 34 had Peleg, and he lived 430 Years after that: The Question is, whether Shem or Eber died the first? and at nine Score and sourteen Years after the Death of the longest Liver, what Interval might be wanting to complete the Term of 1000 Years after the Flood?

35. K. is 19 Years older than L. who was 27 Years of Age in the South Sea Year, 1720: How old is M. in 1740, who, in the Year 1738, was within 24 Years of being as old as both of them together?

36. A. born Anno Christi 318, lived 207 Years before B. who lived 104 Years after C. who was Successor to D. 84 Years. E. was also 112 Years after D. but Predecessor to F, by 47 Years: In what Year of Christ did each of these Gentlemen stourish?

37. Sam was born 28 Years before Toby, who died at 12, and lived 19 Years after him. Rachel came to light when Sam was 16, and died 11 Years before him. Jofhua, when Rachel was 7 Years, being himself then 14, went abroad, where he continued 9 Years, and returning, survived Rachel four Years: How old was each of these, and what is the Sum of their Ages?

38. B. born Anno 1108, lived 48 Years before C. who was 113 Years Senior to D. and X. was 114 Years before Y. who was 74 Years after Z. born Anno 1527: In what Years of Christ were these Men severally born?

39. You were born 34 Years after me: How old shall I be when you are 17? And how old will you be when I am 70 Years of Age?

40. Five notable Discoveries were made in 213 Years Time, viz. 1. The Invention of the Compass. 2. Gun-powder. 3. Printing. 4. The Discovery of America. 5. Truth, in the Reformation. The last was brought about Anno 1517, the third 77 Years before; the second 42 Years after the first, and the fourth 148 Years after the second: The Question is, in what Year of Christ did each of these happen to be found?

41. Three and thirty Years before the Restoration in 1660, the Crown granted Demesnes to certain Uses for 210 Years then to come. The Proprietor, in 1715, procured a reversionary Grant for 99 Years, to commence

Ea

after

after the Expiration of the First: In what Year of Christ will the second Term end?

42. A. was born when B. was 18 Years of Age; how old fhall A. be when B. is 41? and what will be the Age of

B. when A. is 72?

43. The Building of Solomon's Temple was in the Year of the World 3000: Troy was by Computation built 443
Years before the Temple, and 260 before London: Now Carthage was built 113 Years before Rome, founded 744
Years before Christ, born Anno Mundi 4000; is London or Carthage the ancienter City, and how much?

44. If the mean Distance between the Earth and Sun be 81 Million of Miles, and between the Earth and Moon 240 Thousands, how far are those two Luminaries assunder in an Eclipse of the Sun, when the Moon is lineally between the Earth and Sun? and in another of the Moon, when the Earth is in a Line between her and him?

45. From the Creation to the Flood was 1656 Years; thence to the Building of Solomon's Temple 1336 Years; thence to Mahomet, who lived 622 Years after Christ, 1630 Years: In what Year of the World was Christ then born?

46. Seth was born when Adam was 130 Years of Age, and 800 Years before our faid Grandsire's Death: Seth at the Age of 105 Years had Enos: He, at 90, was Fatherto Canaan, who at 70 had Mahaleel. This Man at 65 begat Jared, who, having lived at 162 Years, was Father to Enoch: this Patriarch at 65 Years of Age had Methuselah; and by the Time he was 187 Years of Age, his Son Lamech came into the World, who at 182 Years old was Father to Noah; and when Noah was 600 Years old, the Flood swept away the Bulk of Mankind. In what Year of the World did this happen, and how long after the Death of Adam?

47. Miss Kitty told her Sister Charlotte, whose Father had before lest them twelve Thousand twelve Hundred Pounds a-piece, that their Grandmother by Will had raised her Fortune to sisteen Thousand Pounds, and had made her own twenty Thousand: Pray what did

the old Lady leave between them?

48. The Powder Plot was discovered 88 Years after the Reformation in 1517: The Murder of King Charles the First

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First was committed 43 Years after that Discovery: The Accession of the Brunswick Family to the Crown was in 1714; just 54 Years after the Return of King Charles the Second, who had lived in Exile eyer fince the Death of his Father, Charles the First: How long was that?

49. B. born 161 Years ago, died when C. was 47 Years of Age, who it feems came into the World 180 Years fince, and out-lived B. 43 Years: The Sum of their Ages is required?

50. If Sampson was born 17 Years after Timothy, and Timothy 26 Years before Jacob, who 28 Years hence will be just 50. In what Year of Christ were they severally born; the Question being proposed Anno 1784?

51. A. born 445 Years before the Year 1733, died Anno 1362; B. born 37 Years ago, will die 18 Years hence? C. born 256 Years ago, died 197 Years fince; D. born Anno 1578, lived till within 75 Years of the faid 1733: The length of these People's Lives is severally required?

which was 23 Years before the Reformation in 1517.

B. furvived this remarkable Æra just 49 Years; C. born 9 Years after the Death of A. lived but till B. was 36 Years of Age: The Sum of the Ages of these three Persons is required?

Anno 1502, aged threescore and seventeen; C. in the Year 1577, was 22 Years of Age, and survived that Time 54 Years; D. Anno 1616, had lived just Half his Time, and died in 1648; E. was 13 Years old at the Death of D. and 14 Years after that was Father to F. who was 31 when his Son G. was born, who at his Grand-sire's Death was 7 Years of Age: The Years of Christ, wherein these Men were born, and the Years wherein the first five of them died, are severally required?

54. A. born 17 Years after C. and 13 before B. died 42 Years before King George the Second's Inauguration in 1727, aged 47 Years; A. died Anno 1712, and B. exactly 6 Years before him; D. born 23 Years before C. died at 64; E. born 11 Years after B's Death, died 12 Years

after

after the Year 1733; and F. born just in the Midway of the Interval, between the Birth of A. and D's, is not to reach the Time of Death by 14 Years: What is the Sum of all their Ages, and which of them lived longest?

MULTIPLICATION. EXAMPLES of INTEGERS.

(1) 全 (14	276084 749509	(4 (5) à	(147624)	69 748
(3) 至) 1	204674	y { 4 (5) Add (6) (7) W (8) W	10646 by	5278
(4) 4	(9)	3142700	407852	9674
		7680709 by	40700509	
	(12) 3	21700 Dy	954000	
	(14)	10709	L 336	
	CON	TRACT	ONS.	

r. When the Multiplier confifts of the same Figures in all the Places, (i. e.) all 9's or all 7's, &c. then for each Figure in the Multiplier, annex a Cypher to the Multiplicand, and if the repeating Figure is 9, the Remainder will be the Product required; but if any other Figure, multiply it into the ninth Part of the Remainder; or, for the Figure 3, take the third Part of the Remainder; and for 6, multiply the third Part by 2, which will give the required Number.

E X A M P L E S

(1) {47627} {9999}
(2) \(\frac{1}{27464} \) {4674} {4674} {by} {2222}
(4) \(\frac{1}{2} \) {47694} {74760} {3333}
(6) {42763}

2. In many Cases the Work may be performed with more Ease, likewise more concise than is usually practised.

E X A M P L E S. (7) Multiply $\begin{cases} 4276 \\ 6946 \end{cases}$ by $\begin{cases} 126 \\ 486 \end{cases}$

g. COMPOUND MULTIPLICATION
Teacheth to multiply (by one common Multiplier) any Sum
or Number confifting of divers Denominations. 1. When

1. When the given Quantity doth not exceed 12.

RULE.

1. Write the Multiplier (or given Quantity) under the lowest Denomination of the Multiplicand.

2. Multiply the Number of the lowest Denomination by the Multiplier, and divide that Product by as many of that as make one of the next higher Denomination the same which you stopped at in Addition, set down the Remainder underneath its own Place, and add the Quotient to the next superior Denomination, as you multiply, in this Manner proceed with all the other Denominations to the highest.

EXAMPLES of MONEY.

	(. s. d.	. L.	s. d.	£. s. d.
(1) Multiply 1	4 17 11	(2) 140	10 01	(3) 17 6 4
· Draduo -				9

4. 4 Yards of Cloth, at 17s. 61d. per Yard.

5. 5 Hundred of Cheefe, at 31. os. 6d. per Cwt.

6. 7 Ells of Holland, at 7s. 10d. per Ell.

8 Pounds of Tea, at 18s. 9½d. per lb.
 9 Gallons of Wine at 12s. 8d. per Gall.

9. 10 Anchors of Brandy, at 21. 6s. 4d. per Anch.

10. 11 Barrels of fmall Beer, at 12, 7d. per Barrel.

11. 12 Firkins of Butter, at 11. 175. 63d.

2. When the given Quantity exceeds 12, and is such a Number that any two Figures (in the Multiplication Table) being multiplied together will produce it:

RULE.

Multiply the given Price by one of those Numbers, and the Product by the other, which will give the Answer.

EXAMPLES.

12. 14 Ounces of Silver, at 6s. 73d. per oz.

13. 18lb. of Sugar, at 104d. per lb.

14. 27 Quarters

after the Year 1733; and F. born just in the Midway of the Interval, between the Birth of A. and D's, is not to reach the Time of Death by 14 Years: What is the Sum of all their Ages, and which of them lived longest?

MULTIPLICATION. EXAMPLES of INTEGERS

The sex sex like	T TELLIAL'T	TITIO OF TIM	THURKU.	1
(1) = (14276084	(4 (5)	(147624) (69
(2):5)	20749509	9 (6) 5	42768 (hu)	748
(3) Ξ	1204674	12 (7) 3	10646 (by)	5278
(1) kld illuM (2) illuM (4) (4)	4074746	10 (8)	14276)	39674
			467852	
	(10)	27680709	40700609	
	(11)	2142760 by	4100	100
	(12)3	21700	954000	
	(13) W (13) W (13) W	46904	27	
	(14)	10709	336	
	the second second second	NTRACT	IONS.	

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EXAMPLES of MONEY.

(1) Multiply	£. s. 14 17	d.	(2)	£. 140	s. 10	d. 01/2	(3)	£.	s. d. 6 4
Product				List	0.0	_	_	de la	9

4. 4 Yards of Cloth, at 17s. 61d. per Yard.

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13. 18lb. of Sugar, at 104d. per lb.

14. 27 Quarters

- 14. 27 Quarters of Wheat, at 21. 9s. 6d. per Quar. 15. 30 Yards of German Serge, at 41. 11 d. per Yard.
- 16. 36 Stone of Wool, at 10s. 8d. per st.

17. 45 Yards of Tape, at 21d. per Yard.

18. 50 Moidores, at 27s. each.

- 19. 56 Yards of Shalloon, at 25. 7\frac{1}{2}d. per Yard.
 20. 64 Firkins of Butter, at 11. 115. per Firkin.
 21. 72 Reams of Paper, at 155. 9d. per Ream.
- 22. 80 Yards of Yorkshire Camblets, at 113d. per Yard.

23. 84 Gallons of Oil, at 9s. per Gallon.

- 24. 96 Yards of Indian Dimity, at 15. 103d. per Yard. 25. 99 Yards of Broad Cloth, at 181. 111d. per Yard.
- 26. 100 Yards of Cambric, at 115. 10d. per Yard.
 27. 120 Hundred of the best Dutch Pens, at 15. 6d. per Hun.

28. 132 Deals, at 1s. 10d. each.

29. 144lb. of Tobacco, at 15. 73d. per lb.

3. When the given Quantity cannot be produced by the Multiplication of two small Numbers.

RULE.

Find the nearest Number to its less, by which multiply as before, then for what is wanting, multiply the Price by that Number, and add to it the last Product, and the Total will be the Answer.

EXAMPLES.

30. 17 Cwt. of Malaga Raisins, at 11. 4s. 10 2d. per Cwt.

31. 19lb. of fine Hyfon Tea, at 191. 112d. per lb.

32. 29 Yards of Diaper, at 15. 72d. per Yard.

33. 38 Dozen of Men's fine common Hose, at 21. 175. 6d. per Dozen.

34. 47 Yards of flowered Linen, at 3s. 10d. per Yard.

35. 58 Ells of Holland, at 10s. 4½d. per Ell. 36. 67 Cwt. of Tobacco, at 51. 17s. per Cwt.

37. 75 Dozen of Soap, at 6s. 4½d. per Dozen.

38. 86 Yards of green Silk Damask, at 19s. 13d. per Yard.

39. 106 of Vyse's Tutor's Guide, at 3s. 6d. each.

4. When the given Quantity confists of \$, \$, or \$. RULE.

RULE.

Divide the upper Line (the Price of one) by 4 for $\frac{1}{4}$, by 2 for $\frac{1}{2}$, and for $\frac{3}{4}$, by 2 first for $\frac{3}{4}$, then divide that Quotient by 2, for $\frac{1}{4}$; add them to the Product, and the Sum will be the Answer required.

EXAMPLES.

40. 351 Tons of Hay, at 31. 6d. per Ton.

41. 761 Dozen of Red Port, at 11. 12s. 10d. per Dozen.

42. 174 Barrels of Ale, at 36s. 64d. per Barrel.

43. 82 Butts of Beer, at 41. 6s. 7d. per Butt.

44. 100 Acres of Land, at 261. 175. 6d. per Acre.

This Method of finding the Value of any Quantity of Goods under 100, at any Price per yd. lb. &c. is of excellent Use to such as buy or sell by Retail.

But for great Quantities, there are other Methods much

better. (See PRACTICE.)

Yet fometimes it may so happen, that your given Quantity, though considerably great, may be wrought by the continual Product of three Numbers, as the following.

EXAMPLES.

45. 112 Bushels of Oats, at 11. 103d. per Bushel. 46. 336 Yards of Dowlas, at 25. 5d. per Yard.

47. 350 oz. of Cloves, at 114d. per oz.

Of WEIGHTS and MEASURES.

(1)	14 lb. 10 02. 0 dwts. 21 grs.		4
(2)	17 Tons, 17 cwt. o q. 24 lb.		2
(3)	14 cwt. o qr. 21 lb. o oz. 14 drs.		7
(4)	10 fb. 6 3. 4 3. 1 9. 17 grs.		7 9
(5)	127 yds. o qr. 3 na.		12
(6)	40 Ells Eng. 4 qrs. 2 na.		11
(7)	120 lea. 7 fur. 24 p.		5
(8) 🚡	147 yds. 2 f. 11 in. 2 b. c.		5
(0).7	16 W bbds 45 col 5 bts	by	3
(10)	6 Tuns, 1. p. 1hhd. 46 gal. 3 qts.		-8
(11)	27 ter. 41. gal. 2 qts.		6
(12)	4 B. hhd. 47 gal. 6 pts.		9
(13)	10 A. hhds. 17 gal. 3 qts. 1 pt.	4	
(14)	12 B. bar. 2 fir. 7 gal. 7 pts.	19	6
(15)	140 A. 21. 26 p.	1190	5
(16)	74 Laft, 7 qrs. 4 bu. 1 p.	36.	7
(17)	1365 D. 5 h. 48 m. 57 fec.	Dist.	12
		PP	LI-

APPLICATION.

1. What Number taken from the Square of 54, will leave 19 Times 46?

2. Suppose 50 Men to take a Prize, and each Man's Share comes to 1421. What is the Value of the Prize?

3. What is the Difference, and what the Sum, of fix dozen

dozen, and half a dozen dozen?

4. A certain Island contains 52 Counties, every County 42
Parishes, every Parish 246 Houses, and every House 10
Persons. I demand the Number of Parishes, Houses, and Persons that are in the whole Island?

5. What Difference is there between twice eight-and-twenty, and twice twenty-eight: As also, between twice five-

and-fifty, and twice fifty-five?

6. By God's Bleffing upon a Merchant's Industry, in ten Year's Time he found himself possessed of 13000l. it appeared from his Books, that the last three Years he had cleared 873l. a Year; the three preceding, but 586l. a Year, and before that, but 364l. a Year. The Question is, what was the State of his Fortune at every Year's End that he continued in Trade, and what had he to begin with?

7. A Robbery being committed on the Highway, there was affessed on a certain Hundred, in the County of S. the Sum of 373l. 14s. 8d. of which the four Parishes paid 37l. 16s. 4d. the four Hamlets 28l. 3s. 10d. each, the 4 Townships 19 Guineas each: What was the Deficiency?

8. At Leicester and several other Places, they weigh their Coals by a Machine, in the Nature of a Steel-Yard, Waggon and all; three of these Draughts together amount to 137 cwt. 2 qrs. 10 lb. and the Tare or Weight of the Waggon was 13 cwt. 1 qr. How many Coals had the Customer to pay for?

9. A Person dying left his Widow 17801. and 12501. to each of his four Children, 30 Guineas a-piece to 15 of his poor Relations, and 1501. to Charities; he had been 25½ Years in Trade, and at an Average had cleared

1261. a Year: What had he to begin with?

and he expends daily 19s. 11d. What doth he lay up at the Year's End?

If

Year's End layeth up 2941. 125. 6d. and at the yearly Income?

12. The Remainder of a Division Sum is 20, the Quotient 423; the Divisor is the Sum of both, and 19 more;

what was the Number to be divided?

13. Suppose that for a Quarter's Rent I pay in Money seven Guineas and six Pence, and was allowed for small Repairs 18s. 6d. for the King's Tax 8s. 9d. What did my

Tenement go at a Year?

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14. A Person dying left his Widow the Use of 50001. To a Charity he bequeathed 8461. 10s. To each of his three Nephews 12301. To each of his four Nieces 10501. To 20 poor House-keepers five Guineas each, and 200 Guineas to his Executor: What must he have died possessed of?

15. A Gentleman gave his Daughter to her Portion a Scrutoire, in which was twelve Drawers, in each of these are fix Divisions, and in each Division there was 1001. a Moidore, and Half a Guinea: What was the young

Lady's Fortune?

QUESTIONS for Exercise at Leisure Hours.

- 16. The Silk Mill at Derby contains 26586 Wheels, and 97746 Movements, which wind off or throw 73726 Yards of Silk every Time the great Water Wheel, which gives Motion to all the rest, goes about, which is three Times in a Minute. The Question is, how many Yards of Silk may be thrown by this Machine in a Day, reckoning ten Hours to a Day's Work? and how many in the Compass of a Year, deducting for Sundays and great Holidays 63 Days; provided no part of it stands still?
- 17. Trajan's Bridge over the Danube is faid to have had 20 Piers to support the Arches, every Pier being 60 Feet thick, and some of them were 150 Feet above the Bed of the River; they were also 170 Feet asunder: Pray what was the Width of the River in that Place; and how much did it exceed the Length of Westminster Bridge, which is about 1200 Feet from Shore to Shore, and is supported by 11 Piers, making the Number of Arches 12?

34: Required the Square of their Product, ditto of their Sum, and Difference, and Sum of those Squares?

rg. There are two Numbers, the bigger of them is 73 Times 109; and their Difference 17 Times 28. I demand

their Sum and Product.

A. had 757 Acres allotted to him; B. had 2104 Acres; C. 16410; D. 12881; E. 11008; F. 9813; H. 13800; and I. 8818 Acres. Now, how many Acres did the Settlement contain, fince the Allotments made as above want 416 Acres of one fifth of the Whole?

21. How many different Ways can four common Dice come up at one Throw?—Note. One may come up fix Ways.

22. In a Company S. had 31. 11s. 2d. more than T. who had fix Guineas less than R. who had within 16s. 8d. of as much as W. who was known to have 100 Guineas wanting ten Marks of 13s. 4d. each: Pray what Money had they among them?

DIVISION.

EXAMPLES of INTEGERS.

(1)	[14076893]		4.
(2)	30742165		12.
(3)	2410296		89.
(4)	98420649		576.
(5)	308763705		3029.
(6)	16221212499		46058.
(7)8	51799555		127345.
(8).≥ <	78855994985	by 3	3090807.
(g)A	1276421427		3700.
(10)	4074964478		827000.
(11)	24769851400		9300.
(12)	67402		14.
(13)	701747		63.
(14)	4170642		112.
(15)	2741724	(336.

CONTRACTIONS.

When the Divisor consists of the same Figure in all the Places, that is, all 9's or all 7's, &c. annex as many Cyphers

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he ny ers Cyphers to Unity or 1, as there are 9's or 7's, &c. in the given Divifor, for a new Divifor; and if the repeating Figure is 9, divide the Dividend by that Divifor, and do the same with the Quotient, till you get 0, for an integral Quotient, then add all the Overplusses together, and divide that Sum by the given Divisor, the Overplus thence arising is that required, and the Sum of all the integral Quotients is the Quotient required; for any other Figure, divide nine Times the Dividend so, and the integral Quotient by the repeating Figure: This gives the true integral Quotient; and if the 9th Part of the first Overplus be added to the Second, repeated as the given Figure, the Sum will be the rue Overplus.

EXAMPLES.

$$\begin{pmatrix}
16 \\
999 \\
(17) \stackrel{?}{\sim} \\
(18) \stackrel{?}{\sim} \\
(19) \stackrel{?}{\sim} \\
\begin{pmatrix}
4677823 \\
2692464 \\
4769042
\end{pmatrix}$$
 by
$$\begin{cases}
999 \\
1111 \\
7777 \\
6666
\end{cases}$$

to. COMPOUND DIVISION

Teacheth to divide (by one common Divisor) either a simple or compound Number, into any proposed Number of equal Parts, whereof each shall be a compound Number.

1. When the Divisor doth not exceed 12.

RULE.

. Place the Divifor and Dividend as Integers.

2. Writing their Quotas under each respective Dividend.

But if there be a Remainder after dividing any of the Denominations except the least, you must find how many of the next lower Denomination it is equal to, by multiplying it by as many of the next less as make one of that, which add to the next (if any) and divide as before.

E X-

EXAMPLES of MONEY.

£	s.	d.	£.	5.	d.
$(1) \begin{array}{c} f \\ 2 \end{array}$	4 16	101	£. 7)267		

(3) 8) 171 +1 4 (4) 9) 317 0 6 (5) 11) 6 6 111

- 6. Bought 3 cwt. of Cheese, for which I gave 71. 113. 6d. at what Rate did I give per cwt.?
- 7. If to Dozen of Candles cost 31. 17s. 1d. what costs one Dozen?
- 8. Suppose I give my Servant 14 Guineas per Year, what does his Monthly Wages come to?
- 2. When the Divisor exceeds 12, and is such a Number that if any two Figures (in the Multiplication Table) being multiplied together will produce it.

RULE.

Divide by component Parts, as in Sect. 5. Case 4.

EXAMPLES.

- 9. Divide 451. 12s. 8d. into 16 equal Parts.
- 10. Divide 31. 131. equally amongst 24 Persons.
- 11. What is Cloth per Yard, when 36 Yards cost 641. 195.
- 12. What is Tobacco per cwt. if 42 cwt. cost 1901. 4s. 6d.
 13. Bought 48 Yards of Broad Cloth for 371. 14s. 8d. I de-
- fire to know at what Rate I gave 1 or Yard?

 14. Suppose a Man spends 781. 163. 8d. in 8 Months Time,
- what is that per Week?

 15. A Prize of 45671. os. 10d. is to be equally divided
- amongst 55 Persons: What is each Man's Share?
- 16. What is Tea per cwt. when 63 cwt. cost 2641. 125.?
 17. If 72 oz. of Silver cost 18 Guineas, what is it per oz.?
- 18. Suppose I have 81 cwt. of Cheese, which cost me 1211. 125. 6d. at what Rate did I buy per cwt.?
- 19. Divide 1741. 1s. 8d. equally amongst 120 Sailors.
- 3. When the Divisor cannot be produced by the Multiplication of two small Numbers. Divide as in Sect. 4. Case 2. EX.

EXAMPLES.

- 20. Divide 2141. 175. 94d. equally among 17 Persons.
- 21. Divide 4761. amongst 145 People.

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The following Examples require three DIVISIONS.

- 22. I gave 301. 25. for 112 Yards of Cambric, at what Rate did I give per Yard?
- 23. Divide 10091. equally amongst 350 Persons.
- 24. Suppose the Cloathing of 224 Charity Children comes to 6101. 8s. what is the Expence of each?
- 25. Divide 14261. equally amongst 640 Persons.
- 4. If the given Quantity or Divisor confists of \(\frac{1}{4}\), \(\frac{1}{2}\), or \(\frac{3}{4}\).

RULE.

Multiply the given Quantity by 4, adding to the Product $1 \text{ for } \frac{1}{4}$, 2 for $\frac{1}{2}$, 3 for $\frac{3}{4}$; and it will give the Divisor, which divide with as before, and the Quotient multiply by 4, will give the Answer.

EXAMPLES.

- 26. Suppose I give for 64 Yards of Cambric, 121. 125. 11d. at what Rate did I buy it at per Yard?
- 27. Suppose a Person in Trade to clear 1061l. 8s. $9\frac{3}{4}d$. equally in $10\frac{1}{2}$ Years, what was his yearly Increase of Fortune?
- 28. Suppose another to clear 4501. 125. 112d. equally in 82 Years, what was his yearly Profit?

Of WEIGHTS and MEASURE.

EXAMPLES.

(1) \{ 8 \text{lb. 1 oz. 15 dwts. 8 grs.} \} \text{(2)} \text{ 24 tuns, 14 cwt. o qr. 14 lb.} \} \text{(3)} \text{17 cwt. 2 qrs. 27 lb. 14 oz. 15 drs.}	3 4 5 9
	4 5 9
	5 9
(4) 4th. 11 3. 4 z. 2 9. 12 gts.	9
(5) 214 yds. 3 qrs. 2 na.	0
(6) 120 ells Eng. 4 qrs.	0
(7) 12 lea. 2 m. o fur. 26 p.	9
(8) 0 147 yds. 2 f. 11 in. 2 b.c.	10
(9): \(\frac{24}{24}\) \(\text{W. hhds. 57 gal.}\) \(\frac{50}{24}\)	11
(10) \(\Omega\) 10 tuns. 1 p. 1 hhd. 60 gal. 3 qts.	8
(11) 16 tier. 20 gal. 7 pts.	6
(12) 76 A. hhds. 27 gal.	5
(13) 12 B. hhds. 49 gal. 2 qts.	4
(14) 61 B. bar. 2 fir. 6 gal.	3
(15) 140 acres, 2 r. 26 p.	12
(16) 60 lasts, 6 qrs. 17 bu. 2 pks.	7
(17) L146 days, 23 h. 24 m. 56 fec.	. 6

APPLICATION.

1. An Army of 10,000 Men, having plundered a City, took 220,000l. What was each Man's Share?

2. A certain Man intending to go a Journey of 336 Miles, and would complete the fame in twelve Days; it is required how many Miles he must travel each Day?

3. What Number added to the 43d Part of 4429 will make the Sum 240?

4. What Number deducted from the 26th Part of 2262 will leave the 87th Part of the same?

5. What Number multiplied by 72084, will produce 5190048 exactly?

6. What Number, divided by 419844, will quote 9494, and leave just a third Part of the Divisor remaining?

7. The Sum of two Numbers is 360, the less is 144; what is their Difference, Product, and larger Quote?

8. The Spectator's Club of fat People, tho' it confifted but of 15 Persons, is said (No. 9) to weigh no less than 3 Tons: How much on an Equality was that per Man?

9. When

9. What Number is that, from which if you deduct the 25th Part of 22325, and to the Remainder add the 16th Part of 9696, the Sum will be 1440?

10. What Number, multiplied by 57, will produce just

what 134, multiplied by 71 will do?

11. Subtract 30079, out of fourfcore and thirteen Millions, as often as it can be found, and fay what the last Re-

mainder exceeds or falls thort of 21180?

12. A Gentleman at his Death left his eldest Son, once and a half what he allotted his Daughter, and to the young Lady 13831. lefs than her Mother; to whom he bequeathed four Times what he left towards the Endowment of Hertford College, Oxon. viz. 1640 Guineas, I require what he intended for his youngest Son, who claimed under the Will half as much as his Mother and Sister? How much less than 300001. did the Testator die worth, after his Debts and Funeral Expences, being 9881. 105. were paid?

13. My Purse and Money, quoth Dick, are worth 12s. 8d. but the Money is worth seven Times the Purse: Pray

what was there in it?

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14. A young Fellow owed his Guardian 741. 18s. 2d. on Balance. He paid off 411. 14s. 8d. and then declared his Sifter owed the Gentleman half as much again as himfelf: On hearing this she pays off in Part 131. 12s. 10d. and gives out that her Uncle William was not then less in Arrear than her Brother and she together. The Uncle hereupon pays in 241. 7s. 3d. and then the Uncle's Brother, who, by the bye, was not the Uncle of those Children, for 1501. undertakes to set them all clear, and has 351. 15s. 5d. he says, to spare: Can that be true?

15. A dealer bought two Lots of Smuff, that together weighed 9 cwt. 3 qrs. 16 lb. for 97l. 17s. 6d. their Difference in point of Weight, was 1 cwt. 2 qrs. 16 lb. and of Price 8l. 13s. 3d. Their respective Weights and Values are

required?

16. A Father left among feven Sons and a Daughter, an Estate confisting of 10,000l. in Cash, with 8 Bills each 54l. 10s. 6d. He ordered 30l. to be bestowed upon his Burial, and his Debts to be paid, amounting to 26ol. then his free Estate to be divided in this Manner, viz. the Daughter to have the 9th Part, and the seven Sons

to have equal Shares: What is the Daughter's Part, and also what is the Share of each Son?

QUESTIONS for Exercise at Leisure Hours.

17. I would plant 2072 Elms, in 14 Rows, twenty-five Feet afunder: How long must the Grove be?

18. A Brigade of Horse, consisting of 384 Men, is to be formed into a long Square, having 32 Men in Front: How many Ranks will there be?

19. Divide 1000 Crowns, betwixt A. B. and C. in fuch a Manner, that A. may have 129 more than B. and B.

178 less than C.

20. Part 2501. give A. 37 more than B. and let C. have 23

fewer.

21. Six of the Female Cricketters that played lately in the Artillery Ground, fetched in Company Strokes as follows, viz. A. B. C. D. E. 207. A. C. D. E. F. 213. A. B. D. E. F. 189. A. B. C. E. F. 234. A. B. D. C. F. 222. B. C. D. E. F. 250. How many did they fetch on the other Side, fince these fix Persons wanted but sourscore and 13 Notches to decide the Game?

22. In order to raise a joint Stock of 10,000l. L. M. and N. together subscribed 8,500l and O. the rest: Now M. and N. are known together to have set their Hands to 6,050l and N. has been heard to say, that he had undertaken for 420l more than M. What did each Pro-

prietor advance?

23. There are two Numbers, whose Product is 1610, the greater is 46: What is their Sum, Difference; and Quotes, what is the Sum of their Squares, and what

is the Cube of their Difference?

24. There are other two Numbers, the greater 7050, which divided by the lefs, Quotes 94; what is the Difference of their Squares; and what's the Square of the Product of their Sum and Difference?

25. What Difference will there be to the Proprietors of an Aqueduct, between doubling an Expence, and halving

a Profit.

26. Part 1500 Acres of Land, give B. 72 more than A. and

C. 112 more than B.

27. One of the Smarts in the Accomptant's Office, making his Addresses in an old Lady's Family, who had five fine

fine Daughters; they told him their Father had made a whimfical Will, which might not foon be fettled in Chancery, and till then he must refrain his Visits. The young Gentleman undertook to unravel the Will, which imported, That the first four of her Girl's Fortunes were together to make 25000l. the four last 33000l. the three last, with the first 30000l. the three first, with the last, were to make 28000l. and the two last and two first 32000l. Now, Sir, if you can make appear what each is to have, and as you like, seemingly, my third Daughter, Charlotte, I am sure she will make you a good Wise, and you are welcome: What was Miss Charlotte's Fortune?

28. By felling 240 Oranges at five for 2d. 120 of which cost me two a Penny, and the other Half three a Penny, I evidently lose a Groat: Pray how comes that about?

29. A. B. and C. play in Concert at Hazard; and at making up Accompts, it appears, that A. and B. together brought off 131. 10s. B. and C. together 121. 12s. and A. and C. together won 111. 16s. 6d. What did they feverally get?

30. Four Persons advance in Trade, as follows, viz. W. X. and Y. raised 3501. 10s. W. X and Z. 3441. 10s. X. Y. and Z. made up together 4001. and W. Y. and Z. contribute 3781. 4s. In the conclusion they parted with their joint Property for 450 Guineas: What did they gain or lose by their Adventure?

31. A Tradesman increased his Estate annually a third Part, abating 1001. which he usually spent in his Family, and at the End of 3½ Years, sound that his neat Estate amounted to 31791. 115. 8d. Pray what had he at outsetting?

32. Ten Pounds a Quarter is allowed to five Auditors of a Fire-Office. They attend about feven Times in the Quarter, and the Absentees Money is always divided equally among such as do attend. A. and B. on these Occasions, never miss, C. and D. are generally twice in a Quarter absent, and E. only once: At the Payment, what had each Man to receive?

33. Suppose a Maid, carrying Apples to a Market, was met by three Boys, and that the first took half what she had,

but returned her back 10, that the fecond took onethird, but returned two; laftly, the third took away half those she had lest, but returned her one, and when she had got clear she had 12 Apples lest: What Number of Apples had she at first?

REDUCTION.

In this, and all the following Rules, all great Names are brought into fmall by Multiplication; on the contrary, all fmall Names into great by Division (6).

EXAMPLES of MONEY.

- 1. In 1301. how many Shillings, Pence, and Farthings?
- 2. How many Pence, Shillings, and Pounds, are in 24000 Farthings?
- 3. In 801. 15s. 113d. how many Farthings?
- 4. Reduce 16921 Farthings to Pounds.
- 5. Reduce 1101. os. 6 2d. to Halfpence.
- 6. How many Pounds, &c. are there in 20553 Halfpence?
- 7. In 1071. 103. 8d. how many Two-Pences?
- 8. Reduce 5348 Two-Pences to Pounds.
- 9. Reduce 61. 17s. to Three-Pences.
- 10. In 2782 Three-Pences, how many Pounds, &c.?
- 11. In 101. 10s. 8d. how many Four-Pences?
- 12. Reduce 3859 Four-Pences to Pounds.
- 13. How many Six-Pences are there in 2001. 175.?
- 14. Reduce 795 Six-Pences to Pounds, &c.
- 15. In 21 Guineas, how many Shillings, Pence, and Farthings?
- 16. How many Guineas in 24192 Farthings?
- 17. In 12 Moidores how many Farthings?
- 18. How many Moidores are there in 3240 Pence?
- 19. In 301. how many Crowns, Half-Crowns and Pence?
- 20. Reduce 20160 Pence to Half-Crowns, Crowns, and f.
- 21. In 25 Crowns how many Shillings, Groats, and Pence?
- 22. Reduce 25200 Pence to Groats, Shillings, and Crowns. 23. In 251. how many Shillings, Crowns, and Pence?
- 24. How many Shillings and Pounds in 80 Crowns?
- 25. How many Crowns, Half-Crowns, and Shillings, are in 2131. 151. 6d. and of each an equal Number?

 26. In

- 26. In 1201. how many Half-Crowns, Crowns, Groats, and Shillings?
- 27. In 36 Crowns, as many Half-Crowns, Shillings, and Groats, how many Pounds?
- 28. Reduce 4701. 17s. to Shillings and Moidores?
- 29. Reduce 240 Guineas to Shillings, Crowns, and Pounds.
- 30. In 21 Purses, each Purse with 21 Guineas, a Crown, and a Moidore in, what Sterling do they contain?

COINS.

1. To Reduce Foreign and English Coin to Pounds Sterling.

RULE.

Multiply the given Number of Pieces, by the Shillings, Six-Pences, Four-Pences, Three-Pences, Two-Pences, Pence, or Halfpence, &c. that are in one Piece, and the Product will be according, which bring into Pounds Sterling.

EXAMPLES.

- 31. How many Pounds Sterling are there in 1178 Dollars, at 4s. 3d. each?
- 32. In 470 Pistoles, each 17s. 6d. how many Pounds Sterling?
- 2. To Reduce Pounds Sterling into Foreign and English Coin, &c.

RULE II.

Reduce the given Pound Sterling, and the given Coin, into one Name, that is, if you can reduce them both into Shillings, Six-Pences, Four-Pences, or Three-Pences, &c. do so; then divide one by the other, and the Quotient will be the Answer.

EXAMPLES.

33. A Merchant is to pay 2491. 75. 6d. With how many Quarter Guineas can he do it?

34. In

34. In 3871. 18s. 4d. how many Florins at 3s. 2d. each?

3. To reduce one Kind of Coin into another Kind of Coin.

RULE.

To reduce both Coins into the same Denomination, and then divide one by the other.

EXAMPLES.

35. How many Crowns of 5s. 4d. each, are in 474 Pistoles of 18s. 6d. each?

36. How many Guineas are equal in Value to 1240 Moidores?

Of WEIGHTS and MEASURES.

1. In 14 lb. of Silver, how many Ounces, Penny-weights, and Grains?

2. How many lb. of Silver are there in 138240 grs.?

3. In 19 lb. 10 oz. 17 dwts. 22 grs. how many Grains?

4. Reduce 74342 grs. to Pounds.

5. In 4 Ingots of Silver, each weighing 4 lb. 6 oz. 22 grs. how many Grains?

6. How many Ingots of 6 lb. 11 oz. 14 dwts. each, are there in 2410,56 grs.?

7. How many lb. of Silver are there in one Dozen of Dishes, each weighing 25 oz. 15 dwts. and one Dozen of Plates, each weighing 15 oz. 15 dwts. 22 grs?

8. A Gentleman fent 455 oz. 1 dwt. 16 grs. of old Plate, to his Silversmith, with Orders to make it into the sollowing Articles, viz. Punch Bowls, each 24 oz. 4 dwts. Tankards, each 11 oz. 14 dwts. Tea-pots, each 10 oz. 10 dwts. Lamps, each 20 oz. 17 dwts. 21 grs. Plates, 127 oz. 11 dwts, per Dozen. Spoons, of 36 oz. 17 dwts. 23 grs. per Dozen. How many of each must he make, supposing for every Dozen of Plates and Spoons he is to make one of each of the other?

9. In 4 th. 10 3. 4 3. 19. 12 grs. how many grs.?

10. Reduce 59934 grs. to 3. and 16.

It. In 6 Tons, how many cuts. qrs. and lb.?

12. How many Tons in 26880th.?

13. Reduce

- 13. Reduce 74 cwt. 2 qrs. 16 lb. 7 dr. to Drams.
- 14. In 29768 oz. how many Hundred Weight?
- 15. Reduce 67 lb. 12 oz. 15 drs. to Drams.
- 16. In 6 hhds. of Tobacco, each weighing net 6 cwt. 3 qrs. 27 lb. how many Pounds?
- 17. How many hhds. of Sugar, each weighing 11½ cwt. are there in 12880 lb.?
- 18. In 507 cwt. of Lead how many Fother?
- 19. Out of 12 cwt. 3 qrs. 12 lb. of Tea, how many Canifters can I fill, each Canifter holding 12 lb.
- 20. How many Parcels, each 126½ lb. can I have out of one hhd. of Sugar weighing net 8¾ cwt.?
- 21. How many Parcels of 6 lb. 8 lb. 12 lb. and 16 lb. can a Grocer have out of two hhds. of Tobacco, each weighing net 4 cwt. 3 qrs. 24 lb. and to have of each a like Number?
- 22. Reduce 24 great Pounds, at 24 oz. each, to common Pounds, at 16.
- 23. In 120 common Pounds, how many great Pounds?
- 24. In 27 yds. 3 qrs. of Cloth, how many Nails?
- 25. How many Yards in 352 Nails?
- 26. Reduce 30 Eng. Ells, 4 qrs. 3 na. to Nails.
- 27. In 569 Nails how many Fl. Ells?
- 28. In 14 Pieces of Cloth, each 24 yds. how many Nails?
- 29. Reduce 24768 Nails to Pieces, each 12 Yards.
- 30. In 12 Pieces of Cloth, each containing 20 Flem. Ells, how many Ells English?
- 31. How many Pieces of Cloth, each 24 Ells Flemish, are there in 227 Yards?
- 32. In 4 Bales of Cloth, each 12 Pieces, and each Piece 24 Ells Fl. how many Ells English?
- 33. In 60 Miles how many Furlongs and Poles?
- 34. Reduce 12800 Poles to Miles.
- 35. In 16 Miles, how many Feet, Inches, and Barley-Corns?
- 36. Reduce 2280060 Barley-Corns to Miles.
- 37. How many Barley-Corns will reach from London to Newcastle upon Tyne, being 276 Miles?
- 38. How many Times doth the Wheel which is 18½ Feet in Circumference, turn between London and York, being 197 Miles?
- 39. How many Barley-Corns will reach round the Terref-

trial Globe, which is 360 Degrees, and each Degree 692 Miles?

40. In 64 Acres of Land how many Roods and Poles?

41. Reduce 21760 Poles to Acres.

42. A common Field, containing 774 Acres, is to be divided into Shares of 270 Perches each, how many Shares doth the whole contain?

43. A Person rents a Farm, which contains 200 Acres of Land, but he is to till no more than $96\frac{1}{2}$ Acres, I desire to know how many Perches there are in the Remainder?

44. In 12 Tierces of Wine, how many Gallons and Pints?

45. How many Tierces in 6048 Pints?

46. In 4 hhds. 42 gal. 2 qts. of Wine, how many Quarts?

47. How many hhds. of Wine in 5746 Pints?

48. A Gentleman ordered his Butler to bottle off a Pipe of red Port into Quart Bottles, how many Dozen will the faid Pipe fill?

49. In a Tun of Oil how many Quarts, Pints, and Half-

Pints, and of each an equal Number?

50. How many Pipes, Puncheons, Hogsheads, and Tierces, and of each a like Number, are there in 1890 Gallons?

51. In 12 Barrels of Ale, how many Gallons and Pints?

52. How many Barrels of Ale in 1704 Pints?

53. In 6 bar. 2 fir. 7 gal. of Beer, how many Gallons?
54. In ten hhds. 42 gal. 4 pts. of Ale, how many Pints?

55. In 2017 qts. of Ale, how many hhds.?

56. In 12 hhds. of Beer, how many Barrels?

57. In 18 Barrels of Ale, how many hhds.?

58. In 4 Tuns, 1 b. 1 hhd. 49 gal. of Beer, how many hhds. bar. and fir. and of each a like Number?

59. Reduce 24 qrs. of Wheat to Bushels, Pecks, and Gal-

lons.

60. In 3360 Gallons of Corn how many Quarters?

61. How many Quarters and Bushels are there in 42 la. 4 qrs. 7 bu. of Wheat?

62. In 40 Chaldron of Coals, how many Bush. and Pecks?
63. How many Chaldron of Coals are there in 4762 Bush.?

64. In 47 cha. 30 bush. of Coals, how many Sacks, each 3
Bushels?

65. How many Chaldron of Coals are there in 6450 Sacks, each 3 Bushels?

66. How

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66. How many Minutes are there in a Julian Year?

67. Reduce 2073600 Seconds to Days.

68. In a Lunar Month, or 27 d. 7 h. 43 m. 5 fec. how many Seconds?

69. How many Thirds are there in a Solar Year?

70. In 31557600 Seconds how many Days?

71. How many Days is it fince the Birth of our Saviour to Christmas, 1784, (allowing Julian Years)?

72. Suppose London was built in 1108 Years before the Birth of our Saviour; how many Days is it fince to Christmas, 1784, (allowing the Year as before)?

2. The RULE of THREE DIRECT

Teacheth by three Numbers given to find a fourth in fuch Proportion to the Third as the Second is to the First, for which Reason it is termed the Rule of Proportion, as it is called the Rule of Three, from its having three Numbers given; and because of its excellent and extensive Use in Arithmetic, it is often named the Golden Rule.

To perform which observe the following

RULE.

1. State or place the Numbers in fuch Order, that the first and third Terms be of the fame Kind; and the second of the same with the Number required.

2. If your first and third Terms consist of divers Denominations, reduce them into one, and the Second into

the lowest Name mentioned.

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3. Multiply the fecond and third Terms together, and divide that Product by the First, the Quotient will be the Answer to the Question in the same Denomination or

Name you left your fecond Term in.

4. If there happens to be a Remainder after the Division, reduce it into the next Denomination below the last Quotient, and divide by the same Divisor, the Quotient will be so many of the said next Name; proceed in this Manner to the least Name, and all the Quotients together will be the Answer.

G 2

EXAMPLES.

1. If 3 Yards of Cloth cost 18s. what will be the Value of 17 Yards, at the same Rate?

2. If 2 lb. of Sugar cost 13. 6 d. what will 24 lb. of the same

coft?

- 3. If 4 lb. of Candles cost 2s. 6d. what will 6 Dozen cost at the same Rate?
- 4. If 1 cwt. of Cheese cost 26s. what will 40 cwt. of the fame come to?
- 5. Suppose I give $7\frac{1}{2}d$. for 1 oz. of Cossee, what must I pay for 1 cwt.?
- 6. Bought 36 oz. of Silver at the Rate of 55.4d. per Ounce, what does the whole come to?
- 7. If I buy 12 Pieces of Cloth, and each Piece contains 30 Yards, at 175. 6d. per Yard; what is the Value of the whole?
- 8. Bought 1 cwt. of Tea, for which I was to give at the Rate of 7s. 9d. per lb. what doth the whole stand me in?
- 9. A Grocer bought 2 cwt. 1 qr. 14 lb. Weight of Cloves, which cost him 341.65. and he would gain 61. by the Bargain, at what Rate must he fell them at per lb.?
- 10. Suppose I have by me 200 Yards of Cambric, which cost me 901. but some Damage having happened to it, I am willing to lose 71. 10s. by the whole; at what Rate then must I sell it per Ell English?

11. If 9 Dozen Pound of Candles cost 21. 55. what will 4 lb.

of the fame cost?

12. A Grocer bought 4 hhds. of Sugar, each weighing net 12 cwt. 2 qrs. 24 lb. and gave after the Rate of 6 d.

per lb. I demand what the 4 hhds. came to?

13. A Merchant at London buys 46 Tuns of Port Wine, which cost him 579l. 12s. the Freight thereof from Port to London cost 46l. the Loading and Unloading 6l. (utem 10l. the Charge of the Cellar 4l. and he would 12in 36ol. by the Bargain.

A Gentleman comes to him and demands the Price of 26 Tuns of the faid Wine: Quere, what must be give?

14. A Factor bought of a Farmer 12 cwt. 2 qrs. 14 lb. of Cheefe, and was to give 32s. 6d. per cwt. what must the Farmer receive for his Cheefe?

15. If

15. If 1 cwt. of Tea cost 891. 16s. 4d. at what Rate must it be sold per lb. to lose by the whole 121.

16. If in four Months I fpend as much as I gain in three, how much do I lay by at the Year's End, if I gain every 6 Months 1851. 55. 6d.?

17. How many Dozen Pair of Gloves, at 16d. per Pair, will pay for 36 Dozen and 8 Pair of Stockings, at 4s. 6d.

per Pair?

18. Bought a Parcel of Cloth at the Rate of 6s. 6d. for every two Yards, of which I fold a certain Quantity at the Rate of 18s. 9d. for every 5 Yards, and gained thereby as much as 180 Yards cost, now I demand how many Yards I fold?

19. How many Pieces of Holland, each 20 Ells Flem. may

I have for 231. 8s. at 6s. 6d. per Ell English?

20. How many Ingots of Silver, each 4 lb. 1 oz. 14 dwts. can I buy for 102l. 16s. 6d. supporting I gave at the Rate of 5s. 10d. per Ounce?

21. Suppose I give at the Rate of $8\frac{3}{4}d$. per oz. for Coffee, how many Parcels, each 1 cwt. can I have for 4261. 165.?

22. A Gentleman having an Estate of 4881. 55. per Ann. he is desirous to know how much he may spend daily, so that he may lay up 100 Guineas at the Year's End?

23. Suppose a Gentleman has an Estate of 5641. 125. per Ann. and he is rated at 35. 9d. per Pound for the Land-

Tax. Quere, his net yearly Income?

Ingots, each weighing 2 lb. 10 oz. 12 dwts. may I have for 2001.

25. A Draper bought of a Merchant 6 Packs of Cloth, every Pack had 6 Parcels, and each Parcel contained 10 Pieces, every Piece was 30 Yards; he gave after the Rate of 21. 45. 3d. for 3 Yards: I defire to know what the 6 Packs cost him per Yard?

26. If 16 Weeks Pay comes to 141. 16s. what is that per

Year?

27. A Butcher goes with 1161. 14s. to Smithfield Market, and buys Cattle at the following Prices, viz. Oxen at 101. each, Cows at 71. each, Calves at 11. 10s. each, Sheep at 19s. each, and of each the fame Number: how many of each Sort will the faid 1161. 14s. buy?

28. A Person failing in Trade owed me 5601. for which I G 3 received

received only 3741. 10s. 62d. at what Rate did I re-

ceive per Pound?

29. The net Proceeds of a hhd. of Barbadoes Sugar, wt. 18 cwt. 3 qrs. 17 lb. 7 oz. was 4l. 14s. 6d. the Custom and Fees 2l. 8s. 6d. Freight 1l. 2s. 8d. Factorage 4s. 6d. Pray how must I fell it at per cwt. so that I may gain 5l. 10s. by the whole?

30. A certain Tower projected upon level Ground a Shadow, to the Distance of 63 Yards 1 Foot, when a Staff, 3 Feet in Length, perpendicular erected, cast a Shadow of 6 Feet 4 Inches, from hence the height of the

Tower is required?

31. Suppose a Person travels 285 Miles in 6 Days, 4 Hours, at what Rate is that per Hour, (allowing 12 Hours to the Day)?

32. Suppose I give 441. 2s. for one Pipe of Wine, at what

Rate did I give per Pint?

33. The Globe of the Earth, under the equinoctial Line, is 360 Degrees in Circumference; and this Body being turned on its own Axis, in the fydereal Day or 23 Hours, 56 Minutes, at what Rate an Hour are the Inhabitants of Bencoolen, (fituated in the Midst of the Torrid Zone) carried from West to East by this Rotation?

34. What is the Value of one Grain of Gold, when one

Ounce costs 5 Guineas?

35. If 12 Apples are worth 21 Pears, and 3 Pears cost a Haispenny, what will be the Price of fourscore and

four Apples?

36. It is a Rule in some Parishes to affess the Inhabitants in Proportion to Eight-tenths of their Rents: What is the yearly Rent of that House, which pays 81. 10s. to the King under this Limitation, at 4s. in the Pound?

37. If 19 Yards of Yard-wide Stuff exactly line 14 Yards of Silk of another Breadth, how many Yards of the latter will line 184 Pieces of the former, each Piece holding 284 Yards?

38. In 117 Times 406 Pieces of Coin, worth 31. 8d. a piece,

how many Reas at 20 for 3d. English?

39. A Merchant bought 274 Ells Flemish, of Holland, for 4s. per Ell, and sold it again for 7s. 10d. per Ell English, what did he gain by the whole?

40. A

40. A May Pole 50 feet 11 inches long, when the Sun is on the Meridian, will cast a Shadow 98 Feet 6 inches long; I would thereby find the Breadth of a River, that running due E. and W. within 20 Feet 6 Inches on the North Side of the Foot of a Steeple, 300 Feet 8 Inches high, which at the same Time throws the Extremity of its Shadow 30 Feet 9 Inches beyond the Stream?

41. If two Men in three Days will earn 155, how much will feven Men earn in the same Time?

42. How far will one be able to travel in 9 Days 8 Hours, at the Rate of 12 Miles every 4 Hours, allowing 12 Hours to a travelling Day?

43. What will 1000 Yards of Walling amount to, at the Rate of 4s. 6d. per Rod?

44. A Factor bought 64 Pieces of Holland, which cost him 3521. at 55. 6d. per Ell Flemish; I demand how many Yards there were in all, and how many Ells English in each Piece?

45. If 1001. in 12 Months gain 41. 155. what will 401. 105. gain in the same Time, the Interest being at the same Rate?

46. If 12 Yards of Yard-wide Stuff exactly line 8 Yards of Silk of another Breadth; how many Yards of the latter will line 24 Pieces of the former, each Piece containing 20 Yards?

47. What is the Quarter's Rent of 240 Acres of Land, at 11. 195. 6d. per Acre per Annum?

48. A Person owes 1000l. but not being able to pay the whole, compounds with his Creditors for to pay them Half a Guinea in the Pound, how much Money doth

he pay his Creditors?

49. When the Sun is in the Meridian at Soho-Square, in what Time will it be fo at Tyburn, lying due West of it at the Distance of a measured Mile, in the Latitude of 51½ Degrees North, where a Degree of Longitude measures 37 Miles, 2 Furlongs, 37 Poles, 5 Feet and 6 Inches, known by the diurnal Rotation of the Earth to pass in 4 minutes Time?

50. How many Pieces of Holland, each 33 Ells Flem. 1 qr. 2 na. can I have for 1181. 175. $7\frac{1}{2}d$. when 4 Ells Engglish cost 11. 75. 10d.

Value of the Shalloons was 601: and the total Quantity

tity of Serge 236 Yards; also for every two Yards of Serge, I had three of Shalloon: how much Shalloon was there, and what was the Value of one Yard of each Sort?

52. If 14s. will buy 8 lb. of Tobacco, how much will 4l. 19s. $1\frac{1}{4}d$. buy at the fame Rate?

53. What will the Carriage of 20 cwt. 2 qrs 16 lb. come

to, at 7s. per cwt.?

54. Bought a Pipe of Port Wine, for which I gave 251. 45. but it leaked out 12 Gallons; the Remainder I fold at the Rate of 18d. per Quart; what was my Gain or Loss in the Whole?

55. If 71. 4s. 9d. be paid for the Carriage of 20 cwt. 2 qrs.

16 lb. at what Rate is that per Pound?

56. How many Bricks, 9 Inches long, and 4 Inches wide, will floor a Room that is 20 Feet square?

QUESTIONS for Exercise at leisure Hours.

57. I am dispatched on a Commission from London to Edinburgh, distant by Computation say, 350 Miles, and my Route is settled at 22 Miles a Day; you, 4 Days after, are sent after me with fresh Orders, and are to travel 32 Miles a Day; whereabout on the Road shall I be

overtaken by you?

58. In the Year 1582 Pope Gregory reformed the Julian Kalendar, ordaining, that as the Year is found to confift only of 365 Days, 5 Hours, and about 49 Minutes, in order to prevent the Inconvenience of carrying the Account of Time too forward, by taking the Solar Year at 365 Days and 6 Hours full, which in a Series of Years must bring Lady-Day to Michaelmas, that the Christian States for the future should drop three Days in Account every 400 Years: that is to fay, for each of the first three Centuries in that Space of Time, the intercalary Day in February should be omitted, but retained as formerly in the last Century, beginning with the Year 1700, when 10 whole Days were funk at once, by which Artifice the Variation of Time will not, at least for a long Space, be very considerable: according to this Regulation, it is required to know in what Year of Christ, the New Style, as it is called, will be twenty Days, as it is now only 11, before the Old Style, which

makes no fuch Allowance?

39. Suppose the Sea Allowance for the common Men to be

3lb. of Beef, and 3lb. of Biscuit a Day, for a Mess of
four People, and that the Price of the first Barrel be
to the King 2½d. per lb. and of the second 15d. such

was the Ship's Company, that their Meat cost the Government 12 Guineas per Day; pray what did it pay

for their Bread per Week?

60. A. fets out from London for Lincoln, at the very fame Time that B. at Lincoln fets forward for London, distant 135 Miles; at eight Hours End they meet on the Road, and it then appeared that A. had rode 2½ Miles an Hour more than B. at what Rate an Hour did each of them travel?

61. A. can do a Piece of Work in 10 Days, B. alone in 13; fet them both about it together, in what Time will it be

finished.

62. B. and C. together can build a Boat in 18 Days; with the Affistance of A. they can do it in 11 Days; in what

Time would A. do it himself?

63. In some Parishes in the Country, they take off 31. one Year in 17 from the Rents in affesting the Farms; what will the landlord receive net out of a Farm of 1401. a Year, in those Places, when the King's Tax is, as now,

4s. in the Pound?

64. A Tradefman begins the World with 10001. and finds that he can gain 10001. in five Years by Land Trade alone, and that he can gain 10001. in 8 Years by Sea Trade alone; and likewise that he spends 10001. in 2½ Years by Gaming; how long will his Estate last, if he

follows all three?

65. If I leave Exeter at ten o'Clock on Tuesday Morning for London, and ride at the Rate of 2 Miles an Hour without Intermission; you set out of London for Exeter at six the same Evening, and ride three Miles an Hour constantly: The Question is, whereabout on the Road you and I shall meet, if the Distance of the two Cities be 170 Miles?

66. If the Sun moves every Day one Degree, and the Moon thirteen, and at a certain Time the Sun be at the Beginning of Cancer, and in three Days after the Moon

in the Beginning of Aries, the Place of their next following Conjunction is required?

67: As I was beating on the Forest Grounds,
Up starts a Hare before my two Grey-hounds:
The Dogs, being light of Foot, did fairly run,
Unto her sisteen Rods, just twenty-one.
The Distance that she started up before
Was fourscore, sixteen Rods just, and no more:
Now this I'd have you unto me declare,
How far they run before they caught the Hare?

Of SOUND.

Sound not interrupted, is by Experiments found uniformly to move about 1150 Feet in one Second of Time.

68. How long after firing the Warning Gun in Hyde Park may the same be heard at Highgate, taking the Distance

at 52 Miles?

69. If I fee the Flash of a Piece of Ordnance, fired by a Vessel in Distress at Sea, which happens we will suppose nearly at the Instant of its going off, and hear the Report a Minute and three Seconds afterwards, how far is she off, reckoning for the Passage of Sound as before?

Of the LEVERS.

There being three Orders of Levers, or three Varieties, wherein the Weights, Prop, or moving Powers, may be differently applied to the Vectis, or inflexible Bar, in order to effect Mechanical Operations in a convenient Manner.

For the First Order, see Page 74.

Of the Second and Third Order of LEVERS.

In Mechanics, a Lever of the Second Order is, where the Power acts at one End, the Prop fixed directly at the other, and the Weight somewhere between them.

In this Order of Levers, their Force is in a contra Propor-

tion to their Length.

In a Lever of the Third Order, the Prop is planted at one End End of the Bar, the Weight at the other End, and the moving Force somewhere between.

- 70. If a Lever be 100 Inches long, what Weight, lying 7½ Inches from the End, resting on a Pavement, may be moved with the Force of 168lb. lifting at the other End of the Lever?
- 71. A Water-wheel turns a Crank, working three Pumprods, fixed just fix Feet from the Joint or Pin; by which their leveral Levers, each nine Feet in Length, are fastened, for the Sake of the intended Motion, at one End, the Suckers of the Pumps being worked by the other, shews them to be Levers of the third Order: Now I would know what the Length of the Stroke in each of the Barrels will be if the Crank be made to play just nine Inches round its Centre?

72. With what force ought that Water-wheel to be driven, which, circumstanced as in the last Question, raises 3 Cubic Feet of Water at every Revolution of the Wheel, each experimentally weighing 62½ lb. Avoirdupoise, the Friction of the Machine rejected?

MOTION of BODIES with their Velocities.

1. If the Quantities of Matter in any two or more Bodies put in Motion, be equal, the Forces wherewith they are moved, will be in Proportion to their Velocities.

2. If the Velocities of these Bodies be equal, their Forces will be directly as the Quantities of Matter contained in them.

- 3. If both the Quantities of Matter and the Velocities be unequal, the Forces with which the Bodies are moved, will be in a Proportion compounded of the Quantities of Matter they contain, and of the Velocities wherewith they move.
- 73. There are two Bodies, the one contains 25 Times the Matter of the other (or twenty-five Times heavier) but the lesser moves with 1000 Times the Swiftness of the greater; in what Proportion are the Forces by which they are moved?

74. There are two Bodies, one of which weighs 100lb. the other 60lb. but the leffer Body is impelled by a Force eight Times greater than the other, the Proportion of

the Velocities, wherewith these Bodies move, is re-

quired?

75. There are two Bodies, the greater contains 8 Times the Quantity of the Matter in the lefs, and is moved with a Force 48 Times greater; the Ratio of the Velocity of these two Bodies is required?

1. In comparing the Motions of Bodies, if their Velocities be equal, the Spaces described by them are in direct Proportion of the Times in which they are described.

2. If the Times be equal, then the Spaces described will be as their Velocities.

- 3. If the Times and the Velocities be unequal, the Spaces will be in a Proportion compounded of the Times and Velocities.
- 76. There are two Bodies, one of which moves forty Times fwifter than the other, but the fwifter Body has moved but one Minute, whereas the other has been in Motion two Hours: The Ratio of the Spaces described by these two Bodies is required?

77. Suppose one Body to move thirty Times swifter than another; as also the swifter to move 12 Minutes, the other only 1, what Difference will there be between the Spaces by them described, supposing the last has moved

60 Inches?

78. There are two Bodies, one whereof has described fifty Miles, the other only 5, but the first hath moved with 5 Times the Velocity of the Second; what is the Ratio then of the Times they have been describing those Spaces?

3. RECIPROCAL PROPORTION;

OR,

The RULE of THREE INVERSE.

Reciprocal Proportion is, when of four Numbers, the Third beareth the same Ratio to the First as the Second doth to the Fourth; therefore the less the Third Term is in respect to the First, the greater will the Fourth Time be in respect to the Second.

RULE

9.

V

b

RULE.

Multiply the First and Second Terms together, and divide their Product by the Third Term, the Quotient will be the Answer.

EXAMPLES.

1. If 48 Men can perform a Piece of Work in 12 Days, how many Men can do the fame in 72 Days?

2. How much in Length, that is four Inches broad, will

make a Foot square?

- 3. Suppose I lend my Friend 500l. for fix Months (allowing the Month to be 30 Days), afterwards he would requite my Kindness by lending me 220l. required the Time I must have it, to requite my former Kindness?
- 4. A Garrison being besieged, has three Months Provisions in it, at the Rate of 14 Ounces per Day each Man; but being informed that it cannot be relieved till the End of 8 Months, how many Ounces per Day must each Man have, that the said Provision may last that Time?

5. If, when the Price of a Bushel of Wheat is 4s. 6d. the Penny Loaf weighs 12 oz. what must the Penny Loaf weigh when the said Bushel is worth but 3s.?

6. Suppose 275 Yards of Cloth, which is 5 qrs. wide, make Coats for 130 Men; how many Yards of Shalloon, of 3 qrs. wide, will line the faid Coats?

7. In what Time will 6001. gain 501. Interest, when 801.

does it in 15 Years?

8. Suppose 2001. would defray the Expences of 10 Men for 43 Weeks and 5 Days; how long would 6 Men be in spending the same Sum?

9. How many Yards of Paper, that is 3 qrs. wide, will hang a Room that is 30 Feet long and 24 Feet wide?

o. A Garrison consisting of 1500 Men, being besieged, have Provisions only for 3 Months, but it being necessary they should hold out 5 Months, how many Men must depart, that the said Provisions may serve that Time?

in 6 Hours: I demand how many Cocks of the fame Capacity there must be to empty the said Vessel in 15 Minutes?

A LEVER of the FIRST ORDER.

A Lever of the First Order hath the Power at one of its Ends, the Weight to be raised is put at the other, and the Fulcrum or Prop somewhere between them.

In this Order, the Power applied at one End will be reciprocally proportional to the Distances of those Ends from the Fulcrum, or Point supported; or in the Steel-Yards, as the Distance of the Weight from the Point of Suspension.

QUESTIONS for Exercise at Leisure Hours.

with the Force of a Hundred and Half on the End of an equipoifed Hand-spike 100 Inches long, which is to meet with a convenient Prop exactly 7½ Inches above the other End of the Machine?

13. What Weight, hung at 70 Inches Diffance from the Fulcrum of a Steel-Yard, will equipoife a hhd. of To-bacco weighing 9½ cwt. freely fufpended at 2 Inches

Distance on the contrary Side.

MOTION of BODIES, with their VELOCITIES.

In comparing the Motion of Bodies, the Ratio or Proportion between their Velocities will be compounded of the direct Ratio of the Forces wherewith they are moved, and the reciprocal of their Quantities of Matter they contain.

14. The battering Ram of Vespasian weighed, suppose 100000 lb. and was moved, let us admit, with such a Velocity, by Strength of Hands, as to pass through 20 Feet in one Second of Time, and this was found sufficient to demolish the Walls of Jerusalem; with what Velocity must a Bullet that weighs but 30 lb. be moved, in order to do the same Execution?

15. A

25. A Body weighing 200lb. is impelled by fuch a Force, as to fend it 100 Feet in a Second; with what Velocity would a Body of 8lb. move, if it were impelled by the fame Force?

CONTRACTIONS in the RULE of THREE.

This being confidered, you may oftentimes perform the Work much shorter than by the general Rule.

1. Divide the Third Term by the First, multiply that Quotient by the Second, and their Product will be the Antwer.

EXAMPLES.

1. If four Yards of Broad Cloth cost 31. 175. 6d. what will a Piece, containing 28 Yards, come to, at the same Rate?

2. If 3 Chests of Tea, each 3 cwt. cost 111. 135. what must I give for 72 cwt. of the same?

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2. Divide the Second Term by the First, multiply that Quotient by the Third, and their Product will be the Answer.

EXA-MPLES.

3. Suppose I give 781. for 26 cwt. of Cheese, what must be given for 156 cwt. of the same?

4. If for 3 lb. of Tea I give 18s. what is the Value of 1 cwt. of the fame?

3. Divide the First Term by the Second, and divide the Third by that Quotient, which will give the Answer.

EXAMPLES.

5. Suppose I give for 6 Gowns, each containing 8 Yards of Stuff, 61. what must be given for 64 Yards, at the same Rate?

H 2

6. If

- 6. If I give 12s. for 24lb. of Sugar, what must be given for 12 cwt. of the same?
- 4. Divide the First Term by the Third, divide the Second by that Quotient, and the last Quotient will be the Answer.

EXAMPLES.

- 7. Suppose I give for 3 Pieces of Broad Cloth, each 24 Yards, 641. 145. what must be given for eight Yards of the same?
- 8. If for 6 Parcels of Tea, each 3 lb. I give 121. 19s. what must I give for 6 lb. of the same, at that Rate?
- 5. Divide the First Term by the Third, multiply the Second by that Quotient, and the Product will be the Anfwer.

EXAMPLES.

9. How much in Length that is 3 Inches broad will make a Foot square?

no. If for 48s. I have 225 cwt. carried 512 Miles, how many Hundred can I have carried 64 Miles for the fame Money?

14. COMPOUND PROPORTION;

O R,

The RULE of FIVE,

Is so called, from its having five Numbers or Terms given to find a Sixth, which if the Proportion is direct, the Sixth Term must bear such a Proportion to the Fourth and Fifth as the Third bears to the First and Second. But if the Proportion is Inverse, then the Sixth Term must bear such Proportion to the Fourth and Fifth, as the First bears to the Second and Third, or as the Second bears to the First and Third.

The

The Three first Terms are a Supposition, the Two last a Demand.

RULE S.

1. Let the principal Cause of Gain, Loss, or Action, &c.

be put in the first Place.

2. Let that which denotes Time, Distance of Place, &c. be in the fecond Place, and the remaining one in the third Place.

3. Place the other two Terms which move the Question un-

derneath those of the same Name.

4. If the Blank or Term fought fall under the third Term, multiply the two first Terms together for a Divisor, and the three last for a Dividend, the Quotient arising from them will be the Answer or fixth Term.

5. If the Blank fall under the first or second Term, multiply the third and fourth Terms together for a Divisor, and the other three for a Dividend, the Quotient arifing

from them will be the Answer.

ROOF.

By two Statings

XAMPLE \mathbf{E}

1. If 6 Men can mow 72 Acres of Grafs in 12 Days, how many Men can mow 120 Acres in 4 Days?

2. Suppose 2 Bushels of Wheat will be sufficient for a Family of 6 Perfons 12 Days, how many Bushels will serve 36 Persons 4 Days?

3. Suppose the Salary of 6 Persons for 21 Weeks is 1201. what will be the Salary of 14 Persons for 46 Weeks?

4. If for the Carriage of 40 cwt. 100 Miles, I give ol. 55. what Weight can I have carried 125 Miles for 701. 10s. 33d. at the fame Rate?

5. An Usurer put out 1201. to receive interest for the same; but when it had continued o Months, he took it up, and received for the Principal and Interest 1251. 8s. I demand at what Rate per Cent. per Annum he received?

 H_3

6. What

6. What is the Interest of 259l. 13s. 5d. for 20 Weeks, 2

51. per Cent. per Annum?

7. If a Quantity of Provisions serve 1400 Men 20 Weeks, at the Rate of 14 Ounces per Day each Man; how many Men will the same Provisions maintain for 8 Months, at the Rate of 8 Ounces per Day each?

8. Suppose 8 Men earn 51. in 5 Days, how many Men will

earn 10 Guineas in 12 Days?

9. Suppose 1401. would defray the Expences of five Men for twenty-four Weeks and four Days; how long would twelve Men be in spending 2001. at the same Rate?

10. What Money at 31/2. per Cent. per Annum, will clear

381. 10s. in a Year and Quarter's Time?

for a Week, how many Poor belonged to that Parish, which, when Coals were 36s. per Chaldron, had 41l. to pay in 6 Weeks on that Account?

QUESTIONS for Exercise at Leisure Hours.

12. A. and B. are on opposite Sides of a Wood, 134 Toises or Fathoms about. They begin to go round it both the same Way at the same Instant of Time; A. goes 11 Toises in 2 Minutes, and B. 17 in 3: The Question is, How many Times will they surround this Wood, before the nimbler overtakes the slower?

13. If a Lever, 40 effective Inches long, will, by a certain Power thrown successively thereon, in 13 Hours raise a Weight 104 Feet, in what Time will two other Levers, each 18 effective Inches long, raise an equal Weight 73 Feet; the Force of strait Levers being in

direct Proportion of their Lengths?

14. A Weight of 1½ lb. laid on the Shoulder of a Man, is no greater Burthen to him than its absolute Weight or 24
Ounces; what Difference will he feel between the said Weight applied near his Elbow, at 12 Inches from the Shoulder, and in the Palm of his Hand, 28 Inches therefrom; and how much more must his Muscles then draw to support it at Right Angles; that is, have his Arm extended right out?

15. In giving Directions for making an Italian Chair, the Shafts whereof were settled at 11 Feet between the

Axle-

Axle-Tree, whereon the principal Bearing is, and the Backband, by means of which the Weight is partly thrown upon the Horse; a Dispute arose whereabout on the Shafts the Center of the Body of this Machine should be fixed. The Coachmaker advised this to be done at 30 Inches from the Axle; others were of Opinion, that at 24 it would be a sufficient Incumbrance to the Horse. Now, admitting the two Passengers, with their Baggage, ordinarily to weigh 2 cwt. a piece, and the Body of the Vehicle to be about 70lb. more; pray what will the Beast, in both those Cases, be made to bear more than his Harness?

16. Suppose a Person to travel 152 Miles in 7 Days, when the Days are 12 Hours long; how many Days will he be in travelling 576 Miles, when the Days are 16 Hours long?

17. My Water-Tub holds 147 Gallons; the Pipe usually brings in 14 Gallons in 9 Minutes; the Tap discharges, at a Medium, 40 Gallons in 31 Minutes. Supposing these both carelessly to be left open, and the Water to be turned at 2 in the Morning; the Servant at 5, finding the Water running, shuts the Tap, and is solicitous in what Time the Tub will be filled after this Accident, in case the Water continues slowing from the Main.

18. If the Scavenger's Rate at $1\frac{1}{3}d$. in the Pound, comes to $6s.7\frac{1}{2}d$. where they ordinarily affess $\frac{4}{5}$ of the Rent; what will the King's Tax for that House be, at 4s. in

the Pound, rated at the full Rent?

14. If when Port Wine is 17 Guineas the Hogshead, a Company of 45 People will spend 201. therein, in a certain Time; what is Wine a Pipe, when 13 Persons more will spend 631. in Twice the Time, drinking with equal Moderation?

20. There is an Island 73 Miles round, and three Footmen all start together, to travel the same Way about it; A. travels 5 Miles a Day, B. 8, and C. 10; when will

they all come together again?

21. A certain Man hires a Labourer on this Condition, that for every Day he worked he should receive 15. but for every Day he was idle he should be mulcted 8d. when 390 Days were past, neither of them were indebted to one another; how many Days did he work, and how many Days was he idle?

22. A

- 22. A. lent his Friend B. fourfcore and eleven Guineas, from the 11th of December to the 10th of May following; B. on another Occasion let A. have 100 Marks, from September the 3d to Christmas following: Quere, How long ought the Person obliged to let his Friend use 40l. fully to retaliate the Favour?
- 23. A Man hired a Labourer for 40 Days, on Condition that he should have 20d. for every Day he worked, and forfeit 10d. for every Day he idled; at last he received 21. 15. 8d. for his Labour; how many Days did he work, and how many was he idle?

15. PRACTICE.

So called from the General Use it is to all Persons concerned in Trade and Business.

All Questions in the Rule of Three, where the first Term is Unity or one, may be performed by this Rule.

Which is by taking aliquot or even Parts, by which

Means many tedious Reductions may be avoided.

But as there are a great Variety of fuch Parts, fo many, therefore, are the Ways of applying them, that it would be an endless Task to give all the easy Methods of Operation adapted to particular Cases; so I shall only give the General Rules, with a sufficient Number of Examples to each.

In order to perform this Rule expeditionfly, it will be necessary that the Learner gets by Heart the following

T A B L E S.

1. When the Price is less than a Penny.

RULE.

Divide by the aliquot Parts that are in a Penny, then by 12 and 20, which will give the Answer.

EXAMPLES.

- 1. 2107 at $\frac{1}{4}d$. 2. 1470 at $\frac{1}{2}d$. 3. 1276 yds. at $\frac{3}{4}d$. per yd.
 - 2. When the Price is less than a Shilling.

RULE.

Take the aliquot Part or Parts that are in a Shilling, add them together, and the Sum will be the Answer in Shillings, &c. which, divided by 20 as before, will give £. &c.

EXAMPLES.

- 4. 1762 at 1d. 5. 1400 at $1\frac{1}{4}d$. 6. 2462 at $1\frac{1}{2}d$. per lb.
- 7. 1041 at 13/4d. 8. 2490 at 2d. 9. 2408 at 21/4d.
- 10. 640 at 2½d. 11. 1740 at 2¾d. 12. 746 at 3d.
- 13. 1417 at 31/4d. 14. 3091 at 31/2d. 15. 214 at 31/4d.
- 16. 2000 at 4d. 17. 569 at 41d. 18. 1246 at 42d.
- 19. 1426 at $4\frac{3}{4}d$. 20. 2740 at 5d. 21. 2147 at $5\frac{1}{4}d$.
- 22. 674 at $5\frac{1}{2}d$. 23. 1746 at $5\frac{3}{4}d$. 24. 1741 at 6d.
- 25. 2142 at $6\frac{1}{4}d$. 26. 1040 at $6\frac{1}{2}d$. 27. 1746 at $6\frac{3}{4}d$.
- 23. 1000 at 7d. 29. 1656 at $7\frac{1}{4}d$. 30. 1420 at $7\frac{1}{2}d$.
- 31. 674 at 73d. 32. 2170 at 8d. 33. 1700 at 84a.

- 34. 1765 at 8½d. 35. 749 at 8¾d. 36. 1417 at 9d.
- 37. 2373 at $9\frac{1}{4}d$. 38. 1476 at $9\frac{1}{2}d$. 39. 1760 at $9\frac{3}{4}d$.
- 40. 6000 at 10d. 41. 4652 at $10\frac{1}{4}d$. 42. 2476 at $10\frac{1}{2}d$.
- 43. 2176 at $10\frac{3}{4}d$. 44. 1276 at 11*d*. 45. 2142 at $11\frac{1}{4}d$. 46. 4760 at $11\frac{5}{4}d$. 47. 640 at $11\frac{3}{4}d$.

3. When the Price is more than a Shilling, but lefs than two.

RULE.

Take the Part or Parts, with fo much of the given Price, as is more than a Shilling, (as in the last Rule,) which add to the given Quantity, and the Sum will be the Answer in Shillings, &c. which divided by 20, will give £.

Note.—The Method of performing this Case, being so little different from the last, I shall only give a few Examples, which by proper Instructions from the Tutor will suffice.

EXAMPLES

- 48. 1074 lb. at 1s. 103 d. 49. 2140 at 1s. 4d. per Ounce.
- 50. 1749 at 1s. 11½d. 51. 2140 at 1s. 5d.
- 52. 1453 at 15. 7\frac{1}{2}d. 53. 1614 at 15. 10d.

54. 2647 at 15. 113d.

4. When the Price confifts of any even Number of Shillings, under 20.

R U L E.

Multiply the given Quantity by Half the Price, doubling the first Figure of the Froduct for Shillings, and the Rest of the Product will be £.

EXAMPLES.

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EXAMPLES.

- 55. 2476 at 25. 56. 1476 at 4s. 57. 276lb. at 6s. per lb.
- 58. 2100 at 8s. 59. 274 at 10s. 60. 674 at 12s.
- 61. 2680 at 14s. 62. 267 at 16s. 63. 1267 at 18s.
- 5. When the Price is any odd Number of Shillings under 20.

RULE.

Multiply the given Quantity by the Price, and the Product will be the Answer in Shillings, which divided by 20 will give £.

EXAMPLES.

- 64. 2174 at 7s. 65. 1427 at 9s. 66. 647 at 11s. 67. 267 at 13s. 68. 274 at 17s. 69. 1260 at 19s.
- 6. When the Price is Shillings, or Shillings and Pence, and they an aliquot Part of a Pound.

RULE.

Divide by the aliquot Part, and the Quotient will be the Answer.

EXAMPLES.

- 70. 2420 at 4s. 71. 1764 at 5s. 72. 4762 at 1s. 8d. per yd.
- 73. 467 at 25. 6d. 74. 1760 at 35. 4d. 75. 176 at 65. 8d.
- 7. When the Price is Shillings, Pence, and the Shillings and Pence be not an aliquot Part of a Pound.

RULE.

Multiply the given Quantity by the Shillings, and take Parts for the Pence, &c. add them together, and the Sum will be the Answer in Shillings, which, divided by 20, will give £.

EXAMPLES.

76. 1420 at 35. 3d. 77. 427 at 55. 9d. per Yard.

78. 402 at 10s. $8\frac{3}{4}d$. 79. 174 at 17s. $9\frac{1}{2}d$.

80. 273 at 19s. 43 d. 81. 260 at 14s. 113 d.

8. When the Price is Pounds only.

RULE.

Multiply the given Quantity by the Price, and the Product will be the Answer.

EXAMPLES.

82. 120 at 41. 83. 96 at 171. per cwt.

84. 100 at 31. 85. 142 at 421.

9. When the Price is Pounds and Shillings.

RULE.

Multiply the Quantity given by the Pounds, as in the last Case, and proceed with the Shillings; if they are even, as in Case IV. but if odd, take aliquot Parts, add them together, the Sum will be the Answer; or reduce the given Price to Shillings, by which multiply the given Quantity, and divide by 20, will give the Answer.

EXAMPLES.

86. 649 at 21. 6s. 87. 526 at 71. 16s. 88. 142 at 11. 17s.

89. 164 at 241. 191. 90. 271 at 51.71. 91. 604 at 201. 91.

92. 914 at 101. 15s. 93. 737 at 11. 14s.

10. When the Price is Pounds, Shillings, and Pence, and the Shillings and Pence be an aliquot Part of a Pound.

RULE.

Multiply the given Quantity by the Pounds, as in the last Rule; and take Parts for the Shillings and Pence, as in Case VI. add them together, and the Sum will be the Answer.

X A M P L E S. E

94. 274 at 71. 6s. 8d.

95. 120 at 121. 3s. 4d.

96. 97 at 91. 1s. 8d.

97. 512 at 421. 55.

11. When the Price is Pounds, Shillings, Pence, and Farthings, and the Shillings and Pence be not an aliquot Part of a Pound.

U L E. R

Reduce the Pounds and Shillings into Shillings, multiply the given Quantity by the Shillings, as in Cafe IX. take Parts for the Pence and Farthings, as in Cafe II.

Note.—When the given Quantity doth not exceed 100, proceed as in Sect. 9.

X A M PL E S.

98. 1472 at 41. 6s. 7 d. 279 at 61. 11s. 93 d. 99. 100. 1420 at 191. 145. 113d. 101. 2074 at 11. 175. 51d. 102. 27 at 41. 11s. 87d. 103. 64 at 121. 131. 74d.

12. When the Price and Quantity given are of several Denominations.

I

RULE.

RULE.

Multiply the Price of one, by the Quantity given, and take Parts for Quarters, Pounds, &c. add them together, and the Sum will be the Answer.

EXAMPLES.

- 104. Bought 7 cwt. 3 qrs. 18 lb. of Sugar, at 17s. 6d. per cwt. what comes it to?
- 105. Sold 420 oz. 15 dwts. 16 grs. of Gold, at 31. 16s.
- 106. Bought Tobacco at 31. 17s. 4½d. per cwt. what is the Worth of 72 cwt. 3 qrs. 19 lb.?
- per cwt. what do they stand me in?
- 108. Sold 23 cwt. 18 lb. of Sugar, at 41. 145. 12d. per cwt. what comes it to?
- rog. What is the Rent of 476 Acres, 3 Roods, 28 Perches, at 31.75.11d. per Acre?
- 110. Sold 16 cwt. 2 qrs. of Tallow, at 21. 6s. 11d. per cwt. what comes it to?
- 111. Sold 48 cwt. 2 qrs. 7 lb. of fine Hyson Tea, at 741.
 16s. 6d. per cwt. what must I receive for the same?
- at 41. 17s. per cwt.?
- 113. What is the Value of 17 lb. of Malaga Raisins, at 31. 51. 4d. per cwt.?

When the Pupil is perfect in all the Rules to the foregoing Cases, he may then be taught the Contractions.

EXAMPLES.

- 1. 1276 at 3d. 2. 1740 at 23d. 3. 1420 at 7 d.
- 4. 3162 at 15.7d. 5. 427 at 55.9d. 6. 246 at 175. 10d.

7. 241 at 61. 19s. 8. 641 at il. 15s.

16. TARE and TRETT.

In this Rule there are fix Things to be observed, viz.

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I. The

1. The Gross Weight. 2. Tare. 3. Trett. 4. Suttle. 5. Cloff. 6. Net Weight.

1. The Gross Weight is the whole Weight of the Goods,

and that which they are packed up in.

2. Tare is an Allowance made to the Purchaser for the Weight of the Box, Bag, Barrel, or whatever contains the Goods bought, and is either

At so much in the Whole Gross Weight; At so much per Box, Bag, &c.;—or,

At fo much per Cent.

3. Trett is an Abatement of 4 lb. per 104 lb. and is the twenty-fixth Part allowed for Waste, Dust, &c. made by the Merchant to the Buyer.

4. Suttle is when the Tare is deducted from the Gross.

5. Cloff is an Allowance of 2 lb. to the Citizens of London on every Draught above 3 cwt. on some Sorts of Goods, 2s Beaver, Galls, Madder, Argol, &c.

6. Net Weight is when all Allowance is deducted from the

Grofs.

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1. When the Tare is at so much in the Gross Weight, to find the Net.

RULE.

Subtract the Tare from the Gross, and the Remainder is the Net Weight.

EXAMPLES.

1. What is the Net Weight of 24 Hogsheads of Tobacco, each weighing 6 cwt. 2 qrs. 17 lb. Gross? Tare in the whole 17 cwt. 3 qrs. 27 lb.

2. What is the Net Weight of 5 hhds. of Sugar, weighing

as follows, viz.

		cwt.	grs.	lb.		16.
No.	1.	4	2	14	Tare o	21
	2.	3	0	17	0	18
	3.	5.	3	10	1	11
	4.	6	1	16	0	27
	5.	3	2	18	0	19
	Grofs					
	Tare				11.	
	Net					i.

2. When Tare is at fo much per Box, Bag, &c. to find the Net Weight.

RULE.

Multiply the Tare of each Box, Bag, &c. by the Number of Boxes, &c. the Product Subtract from the Gross as before. and the Remainder will be the Net Weight.

XAMPLES.

- 3. What is the Net Weight of 8 Frails of Raisins, each
- weighing 2 cwt. 3 qrs. Gross, Tare at 22 lb. per Frail?
 4. What is the Net Weight of 40 Bales of Silk, each weighing 3 cwt. 27 lb. Gross, Tare at 18 lb. per Bale?
- 3. When Tare is at so much per cwt. to find the Net Weight.

R-U-LE.

Divide the whole Gross by the said Part or Parts, that the Tare is of a cwt. and the Quotient thence arising will be the Tare, which subtracted from the Gross, as before, will give the Net Weight.

L E S. A A BANG THE E XAMP

- 5. What is the Net Weight of 22 Barrels of Figs, each 2 cwt. 1 gr. 17 lb. Grofs, Tare at 14 lb. per cwt.?
- 6. What is the Net Weight of 9 hhds. of Sugar, each weighing 6 cwt. 2 qrs. 12 lb. Gross, Tare at 17 lb. per
- 4. When Trett is allowed with the Tare, to find the Net Weight.

R U. L E.

Find the Tare as before, and fubtract it from the Gross, the Remainder will be the Suttle, which divide by 26, and the Quotient will be the Trett, which subtract from the Suttle, the Remainder will be the Net Weight.

EXAMPLES.

EXAMPLES.

7. What is the Net Weight of 16 cwt. 3 qrs. Gross, Tare 1 cwt. 1 qr. 12 lb. and Trett 4 lb. per 104?

8. In 27 Bags of Coffee, each weighing Gross, 2 cwt. 3 qrs. 27 lb. Tare 13 lb. per 112 lb. and Trett 4 lb. per 104 lb. what is the Net Weight?

5. When Cloff is allowed, to find the Net Weight.

RULE.

Divide the whole Gross, by 168, 2 lb. being 168th Part of 3 cwt. or 336 lb. or you may divide the Number of cwts. by 3, which brings them into 3 cwts. then 2 lb. being allowed for every 3 cwt. so as many 3 cwts. as it produces, so many 2 lb. it will allow, which divided by 56, (the double Pounds in a cwt.) the Quotient will be the Hundreds, and the Remainder will be so many 2 lb. to which adding what may be allowed for the odd cwts. qrs. and lb. of the given Weight, will make the whole Cloff, which subtract from the Gross will be the Net Weight.

EXAMPLES.

9. What will be the Net Weight of 5647 cwt. 3 qrs. 13 lb. Grofs, allowing for Cloff 2 lb. for every 3 cwt.?

10. What is the Net Weight of 14 Barrels of Spices, weighing altogether 42 cwt. 3 qrs. Grofs, allowing for Cloff 2 lb. per 3 cwt.?

6. When Tare, Trett, and Cloff, be allowed with any Quantity (Gross) to find the Net Weight.

RULE.

For the Tare and Trett, proceed as in Case IV. and the Remainder, which was called the Net there, will be the Suttle here, which to find the Cloff of, proceed as in the last Case.

EXAMPLES.

11. What is the Net Weight of 15 cwt. 3 qrs. 2 lb. Grofs, allowing

allowing for Tare 7 lb. per cwt. Trett 4 lb. per 104 lb.

and Cloff 2 lb. for 3 cwt.?"

12. What is the Net Weight of 4 hhds. of Sugar, weighing as follows, viz.

		rs. lb.	
No. 1.	4 5	2 17 3 14	Tare 8 lb. per cwt. Trett 4 lb. per 104 lb. Cloff 2 lb. per 3 cwt.
3.	3	2 26	104 lb. Cloff 2 lb. per 3 cwt.
4.	0	2 12	

QUESTIONS for EXERCISE.

13. The Net Proceeds of a Hogshead of Barbadoes Sugar. were 41. 14s. 6d. the Custom and Fees 21. 8s. 6d. Freight 221. 8d. Factorage 4s. 9d. The Gross Weight was 9 cwt. 3 qrs. 10 lb. Tare 1 lb. in 10: Pray then how was the Sugar rated in the Bill of Parcels?

14. I have imported 80 Jars of Lucca Oil, each containing 1.180 folid Inches: What came the Freight to, at 4s. 6d. per cwt. Tare 1 lb. in 10, counting 71 lb. of Oil to the

Wine Gallon of 231 cubic Inches?

17. SIMPLE INTEREST

Is that which arises only from the Principal, and is a Profit allowed by the Borrower to the Lender, for the Loan or Forbearance of any Sum of Money, for some determined Space of Time, and at any Rate (per Cent. per Annum) agreed upon; which according to Law must not exceed 5%. for the Use or Interest of 1001. Principal, called Cent. for 12 Months, called Annum.

The Amount is the Principal and Interest added toge-

ther.

Note.—The Rules for Simple Interest, serve also for ealculating Factorage, Brokerage, Infurance, purchasing of Stocks, or any Thing elfe, that is rated at fo much per Cent.

To find the Interest of any Sum of Money, for any Number of Years. lo de la Water fatta de la Constantia

RU LE

Multiply the Principal by the Rate per Cent. that Product divided by 100, will give the Interest for a Year, which multiplied by the Number of Years given, and the Product will be the Answer. Or, by taking the aliquot Part or Parts with the given Rate that are in 1001.

AMPLES. X

1. What is the Interest of 8241. 18s. 2d. for a Year, at four per Cent. per Annum?

2. What is the Interest of 5001. for 4 Years, at 42 per Cent. per Annum?

3. What is the Amount of 264L 4d. for 12 Years, at 5 per Cent. per Annum?

When the Rate per Cent. is \(\frac{1}{4}\), \(\frac{1}{2}\), or \(\frac{3}{4}\), more than the Pounds given in the faid Rate.

RULE.

Multiply the Principal by the Pounds in the Rate per Cent. then take Parts for \(\frac{1}{4}\), \(\frac{1}{2}\), or \(\frac{3}{4}\), from the Principal, which add to the Product, and the Sum divide by 100, as before.

XAMPL E

4. What is the Interest of 2461. 18s. for a Year, at 44 per Cent. per Annum?

5. What is the Interest of 1401. 10s. for 7 Years, at 42 per Cent. per Annum?

6. What is the Amount of 4701. for 5 Years, at 37 per Cent. per Annum?

COMMISSION

Is an Allowance from a Merchant to his Factor, or Correspondent abroad, in buying and selling of Goods, and is at a certain Rate per Cent. according to the Custom of the Country, where the Factor relides.

This, as well as Brokerage and Infurance, is computed in the fame Manner as for even Pounds, and for 1, 1, or 1,

as in the last Case.

EXAMPLES.

EXAMPLES.

7. My Factor writes me Word, that he has bought Goods, upon my Account, to the Value of 474l. 14s. 6d. I demand to know what his Commission comes to, at 34l. per Cent.?

8. Suppose I allow my Correspondent 2½ per Cent. for his Commission; what is his Demand on the Disbursement

of 7421. 125. 6d. ?

BROKERAGE

Is an Allowance or Fee paid unto a Person called a Broker, for affisting others in buying or disposing of their Goods, and in the City of London they are not to act without a Licence from the Lord Mayor.

3. To find the Brokerage for any Sum, at any Rate under 11. per Cent.

RULE.

Divide the given Sum by 100, and it will give the Interest at 11. per Cent. which Interest you must take Parts from, with the Rate per Cent. and add them together, the Sum will be the Brokerage required.

EXAMPLES.

9. What is the Brokerage of 4201. 12s. 6d. at 6s. 4d. per Cent.?

to the Value of 1000 l. what may he demand for Brokerage, it being at 4s. 6d. per Cent.?

11. Suppose a Broker disposes of Goods for me, to the Amount of 540l. 10s. what comes the Brokerage to,

at 13s. 10d. per Cent.?

12. What is the Brokerage of 24741, 155. at 195. 92d. per Cent.?

INSURANCE

Is a Contract or Agreement whereby one or more Perfons, called Infurers, &c. oblige themselves to answer for the the Loss or Damage of Ships, Houses, Goods, &c. by Storms, Fires, &c. in Consideration of a Premium, paid by the Proprietors of the Thing injured.

To 5nd the Infurance of any Sum, at any Rate under 11.

proceed as in the last Case; if above, as in Case I.

EXAMPLES.

13. Suppose I insure for 1460l. at 2s. 6d. per Cent. per Annum, what doth the Insurance come to?

14. What is the Insurance of 2460l. at 101. 155. per Cent.?

on which I made an Infurance at 6%1. per Cent. what does it come to?

16. What is the Infurance of an East India Ship and Cargo, valued at 74061. 175. 6d. at 153d. per Cent.?

PURCHASING of STOCKS.

and the transfer and the Z. C.

Stocks are the public Funds of the Nation, the Shares of which being transferable from one Person to another, occasions that extensive Business called Stock Jobbing.

RULE.

Multiply the Sum to be purchased, by the Excess of the Rate per Cent. above 100, the Product divide by 100, as before, and the Quotient added to the given Sum, will give the required Purchase.

If under Par, i. e. if under 100 per Cent. proceed as in

Case II.

EXAMPLES.

17. What is the Purchase of 4001. South Sea Stock, at 1201. 5s. per Cent.?

18. What is the Purchase of 4701. Bank Stock, at 872 per Cent.?

19. What is the Purchase of 2470l. 175. rod. Bank Annuities, at 103\frac{1}{2} per Cent.?

20. What is the Purchase of 8761. India Stock, at 1145 per Cent.?

4. When the Interest is for $\frac{3}{4}$, $\frac{1}{2}$, or $\frac{1}{4}$ of a Year, or any Number of Years besides.

RULE.

Find the Interest for the Years, as in Case I. then for $\frac{1}{4}$, $\frac{1}{2}$, or $\frac{3}{4}$, take Parts from the Interest of 1 Year, i. e. for $\frac{1}{4}$, take one-fourth Part of the said Interest, for $\frac{1}{2}$, take one-half, and for $\frac{3}{4}$, take the Parts compounded of $\frac{3}{4}$, that is, a half for $\frac{1}{2}$, then half of that half for $\frac{1}{4}$, which added to the Interest for Years (if any) the Sum will be the Interest required.

EXAMPLES.

21. What is the Interest of 4271. 10s. for four Months, at 4 per Cent. per Annum?

22. What is the Interest of 2461. 125. 6d. for 11 Year, at

5 per Cent. per Annum?

23. Lent 2091. 18s. upon a Mortgage, to receive Interest for the same, at 4\frac{3}{2} per Cent. per Annum, till it was paid off, which was not till the end of 4\frac{3}{2} Years after; now I should be glad to know what's due to me?

- 24. A Gentleman dying left his Daughter 6041. 173. 6d. for her Fortune, to be paid her, when at Age, with Interest, at 5½ per Cent. per Annum. Now she came to Age in 3 Years 9 Months after her Father's Death: What is the Amount of her Fortune, that is, what is she to receive in all, Principal and Interest?
- 5. When the Interest required is for any Number of Weeks.

RULES.

1. Find the Interest of the given Sum for a Year, as in Case I.

2. Say, as 52 Weeks: are to that Interest of the given Sum: fo are the Weeks given: to the Interest required. Or you may divide the given Weeks into aliquot Parts of a Year, or 52 Weeks.

2

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EXAMPLES.

25. What is the Interest of 4001. 15s. for 4 Weeks at 4 per Cent. per Annum?

26. What is the Amount of 6001. for 26 Weeks, at 33 per Cent. per Annum?

27. What is the Interest of 7401. for 4 Years and 42 Weeks, at 5 per Cent. per Annum?

28. What is the Amount of 2001. for 5 Years and 50 Weeks, at $4\frac{1}{2}$ per Cent. per Annum?

6. To find the Interest of any Sum, for any Number of Days.

RULES.

for a Year :: fo are the Days given : to the Interest required.

2. (When convenient) divide the Days into aliquot Parts

of a Year, or 365.

- 3. Reduce the Principal into Pence, which multiply by the Number of Days, and that Product by the Rate per Cent. for a Dividend, then multiply 365 (the Days in a Year) by 100 for a Divifor, by which divide the Dividend, and the Quotient will be the Answer in Pence, which bring to Pounds.
- 4. Multiply the given Sum by the Number of Days, and divide the Product by 7300 (viz. \frac{100 \times 365}{5}) the Quotient will give the Interest at 5 per Cent. and for a higher or lower Rate, take aliquot Parts for a Difference, which add or subtract accordingly.

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A TABLE

A TABLE of Days for any given Time less than a Year.

DAYS.	JANUARY.	FEBRUARY.	MAKCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
o d		32	60	91	121	152	182	213	244	274	305	335
2	2	32 33	61	92	122	153	183	214	245	275	30t	336
3 4 5 6	3 4 5 6 17 8	34 35 36 37 38	62	93	123	154	184	215	24t	276	307	337
4	4	35	63	9.4	124	155	185	216	247	277	305 300	330
5	1 5	130	64	95	125	156	186	217	248	278	300	339
		37	65	gt.	120	157	187 186	218	240	279 280	310	340
8	17	30	66	97	127	150	186	219 220	250 251	281	311	341
		39 40	65	98	129	159 160	190	221	252	282	313	342 343
10	9	41	6¢	100	130	161	191	222	253	283	314	344
11	11	42	70	101	131	162	192	223	254	284	315	345
12		42 43	71	102	132	163	193	224	255	285	316 317 318	346
13		44	72	103	133	164	194	225	25t	286	317	347
14	14	44 45	73	104	134	165 166	195 19t	226	257	287	318	347 348
14	14	40	74	105	135		19t	227	258	280	1310	349
16	10	47	75	106	136	167	197	228	259	289	320	350
17	17	48	76	107	137	168	198		200	290	321	351
		49	77	108	138	ito	199	230	261			352
19		5° 51		106	130	170	200	231	262	292	323	353
20		151	79	110	140	171	201	232	263	203	324	354
21		52 53 54	80		141	172	202	233	264	294	325	
22		33	81 82	112	142 143	173	203 204	²³⁴ ²³⁵	266	295 296	326	356
24		55	83	113	143	174	205	236	267	297	$\frac{327}{328}$	357 358
25	1 25	55 5t	84	115	145	176	20t	237	268	298		359
25	25	57	85	116	146	177	207	238	269	299		360
27	1 27	58	85 86	117	147	177	208	239	270		331	361
27	27 28	57 58 59	187	118	148	179	200			301	332	362
29	29	160	188	110	149	180	210	241	272		333	363
30	30		89	120	200	181	211	242	273	303	334	364 365
131	1131	1	190	1	151		212	243		304		365

The USE of the TABLE.

First, To know the Number of Days from the Beginning of the Year to any given Day of any Month.

This is obtained by Inspection only; thus, from January the 1st, to August the 8th, is 220 Days; to November the 24th is 328 Days, &c.

Secondly, To know what is the Number of Days from any given Day of any Month, to the end of the Year.

Suppose August 8th, then from — 365 Days, Subtract the Number answering to August 8, 220

There remains the Number of Days, viz. 145

Thirdly, To find the Number of Days between the given Day of any Month, and the given Day of any other Month, in the fame Year.

For Instance, To know how many Days there are between May the 9th, and November the 5th.

Thus, from the Number answering to Nov. 5, 309 Days,

Subtract that answering to May 9,

The Remainder is the Number of Days sought viz.

Fourthly, To find the Number of Days from any given Day, of any Month in one Year, to any given Day of any Month in the next Year.

How many Days is it from October the 12th in one Year,

to June the 10th in the next?

Thus, from the Days of a whole Year,

Subtract the Number answering to Oct. 12, viz. 285

Remains the Number to the End of the Year, 80
To which add the Number to June 10, 161

The Sum is the Number of Days required, viz. 241

And thus is the Number of Days readily found for any Interval of Time given, in the same Year completely; or which is Part of one, or Part of another Year.

EXAMPLES.

29. What is the Interest of 2001. for 73 Days, at 3½ per Cent. per Annum?

30. What is the Amount of 3401. 10s. from January 1, 1779, to July 18 following, at 5 per Cent. per Ann.?

31. What is the Interest of 500l. from December 4, 1779, to March 10, 1781, at 4 per Cent. per Annum?

When the Amount, Time, and Rate per Cent. are given, to find the Principal.

RULES.

7. 1. Say, as the Amount of 100l. at the Rate and Time given: is to 100l.: fo is the Amount given: to the Principal required. Or,

2. The Examples in this and the two following Cafes

may be folved by the Rule in Sect. XV.

EXAMPLES.

32. What Principal, being put to Interest for 9½ Years, at 4½ per Cent. per Annum, will amount to 8561. 105.

33. What Principal, being put out to Interest for 72 Years, will amount to 6141. 35. 11d. at 3 per Cent. per Ann.?

8. When the Principal, Rate per Cent. and the Amount are given, to find the Time.

RULE.

Say, as the Interest of the Principal for a Year: is to 1 Year: fo is the whole Interest: to the Time required.

EXAMPLES.

34. In what Time will 6001. amount to 8561. 10s. at 4½ per Cent. per Annum?

35. In what Time will 4961. 6s. 8d. amount to 6141. 3s. 11d. at 3 per Cent. per Annum?

9. When the Principal, Amount, and Time, are given, to find the Rate per Cent.

RULES.

RULES.

1. Say, as the Principal: is to the Interest, for the whole Time: : so is 1001. to the Interest for the same Time.

2. Divide that Interest by the given Time, and the Quotient will be the Rate per Cent. required.

EXAMPLES.

36. At what Rate per Cent. per Annum, will 6001. amount to 8,561. 105. in 9½ Years?

37. At what Rate per Cent. per Annum, will 4981. 6s. 8d. amount to 6141. 3s. 11d. in 7\frac{3}{4} Yea rs?

QUESTIONS for Exercise in the Eight last Cases, at Leisure Hours.

38. Lent at Christmas 1771, the Sum of 5000l. at $4\frac{\pi}{2}$ per Cent. after which Time I lent several Sums at the same Rate, and drew upon the Borrower, as Business required; viz. on Lady-day 1772, I drew for 185 Guineas; on Midsummer-day following, I lent 500 Moidores, and drew for 700l. and on Michaelmas-day, in the same Year, I lent 569l. 17s. I demand what Cash the Borrower owed one at that Time?

39. On the first of May 1779, I lent Ralph Newlands, per Bill at one Day's Date, 500l. which I received back in the following partial Payments; viz. on the 13th of May 50l. on the 4th of June 56l. on the 14th of July 44l. on the 23d ditto 50l. on the 18th of August 87l. on the 30th ditto 13l. on the 21st of September 30l. on the 18th of October 30l. on the 29th ditto 40l. on the 11th of November 50l. and on the 28th of December 50l. Now I demand to know what Interest is due at 5 per Cent. per Annum?

40. Lent to John Jameson, per Bill, dated 18th of Jan. 1784, payable one Day after Date, 8781. 19s. 10d. which I received back in the following partial Payments; viz. on the 27th of February 571. 15s. 7d. on the 18th of March 371. 14s. on the 29th of April 341. 11s. on the 12th of May 1361. 15s. 7d. on the 19th of June 671. 13s. 4d. on the 15th of July 15 Guineas and 6d. on the 25th ditto 1111. 11s. 11d. on the 3d of October K 2

781. 75. 4d. on the 19th of November 1001. on the 23d ditto 1001. and on the 30th of December received the Balance of the Principal: How much Interest

ought I to claim at 5 per Cent.?

41. Lent 109 Guineas at 4 per Cent. by the 18th of August 1784, was raised by the Interest to so many Moidores; abating Half a Crown, pray on what Day did the Bond bear Date?

42. If 1001. in 12 Years be allowed to gain 391. 193. 8d. in what Time will any other Sum double itself at the

fame Rate of Interest?

43. A Bond was made on the 7th of August 1773, at 6 per Cent. per Annum, for 11141. 10s. on the 11th of May, 1776, 1401. was paid off, and a fresh Bond entered into tor the Remainder, at 5½ per Cent. per Annum, at the Time the Interest for this last was 211. 16s. 8d. there was paid off 871. 11s. 9d. The old Bond being then taken up, a new one was given for the Residue, which being paid off September 11, 1784, the Bond-owner took no more than 14091. 16s. 8d. in sull Payment: at what Rate did he take Interest per Cent. per Annum, upon the last Renewal of the Bond?

44. It is proposed by an elderly Person in Trade, desirous of a little Respite, to admit a sober industrious young Fellow in the Business; and to encourage him, offers, that if his Circumstances will allow him to advance 100l. his Pay shall be 40l. a Year; if he shall be able to put 200l. into the Stock, he shall have 35l. a Year, and if 300l. he shall receive 70l. annually. In this Proposal, what was allowed for his Attendance simply? and what

Rate per Cent. was allowed for his Money?

45. June 23d, 1745, bought 900l. of New South Sea Annuities, at 111 per Cent. viz. The Day before the closing the Books, the Brokerage whereof is always 2s. 6d. per Cent. on the Capital, whether you buy or fell: The Midsummer Dividend 2 per Cent. became due and payable on the 10th of August following; by which Time the Rebellion growing considerable in the North, the said Annuities were down at 92½ per Cent. In the general Alarm, sold 400l. Capital at that Price; but continued the Remainder, till a second, third, south, and fifth Dividend, as before, came due; and

on opening the Books on the 10th of August, 1747, sold out at 102\frac{5}{8} per Cent. Now reckoning, I might have made 5 per Cent. of my Money, had I kept it out of the Stocks, how stood this Article in point of Profit and Loss?

18. COMPOUND INTEREST

Is that which arises both from Principal and its Interest put together, as the Interest becomes due, but not paid; the same Interest is allowed upon that Interest unpaid, as was upon the Principal, so it becomes a Part of the Principal; and for which Reason it is called Interest upon Interest, or Compound Interest.

It is not lawful to let out Money at Compound Interest, yet in purchasing of Annuities or Pensions, and Leases in Reversion, it is usual to allow Compound Interest to the Purchaser for his Ready Money, and therefore makes it necessary that it should be understood.

But as it may (as well as other Cases of Interest) be more conveniently performed by Decimals, so shall only here give the Rule, and two or three Examples.

RULE.

r. Find the first Year's Interest as in Case I. add that Interest to the Principal, which Sum will become the second Year's Principal, and so on for any Number of Years.

2. Subtract the given Principal from the last Amount, and the Remainder will be the Interest required.

EXAMPLES

- 1. What is the Compound Interest of 600k forborne 3 Years at 5 per Cent. per Annum?
- 2. What is the Amount of 1501 for 5 Years at 4 per Cent. per Annum, Compound Interest?
- 3. What is the Compound Interest of 4401. 16s. for 4 Years 7 Months, and 15 Days, at 5 per Cent. per Annum?
- Note.—When the Interest is required for Months and Days besides Years, you must find the Interest for one Year more than the Number of Years given, and from that K 3 Year'

Year's Interest, take Parts from, for the Months and Days, which add to the last Year's Interest, and the Sum will be the Interest required.

19. REBATE, or DISCOUNT,

Is the abating of fo much on a Debt, to be paid before it becomes due, which Payment (Rebate being deducted) if put out to Interest for the same Time and Rate per Cent, per Annum, would be equal to the Sum first due.

RULES.

1. Find the Interest of rook for the Time given, and

Rate per Cent. which Interest add to 100L

3. As that Sum: is to the Interest of the 100% or to 100: fo is Debt or Sum proposed: to the Rebate or present Worth required. Or subtract the Rebate from the given Sum, and the Remainder will be the present Worth, or Money to be paid down.

EXAMPLES.

1. What is the Rebate of 420h for 7 Months 6 Days, at 5 per Cent. per Annum?

2. What is the present Worth of 1001. for 12 Months, at

6 per Cent.?

3. What is the Rebate and present Worth of 6001. 10s. 6d. payable in 10 Months, at 4 per Cent. per Annum?

4. What is the Discount of 8901. 16s. being due July 27, 1784, this being December 12, 1783, at 5 per Cent.

per Annum?

5. Sold Goods to the Value of 4301. to be paid at two 4 Months, that is, Half at 4 Months, and the other Half at 8 Months: What must be discounted for the present Payment of the Whole, Discount being at 5 per Cent. per Annum?

6. Suppose I have a Legacy of 350% left me on the 21st of May, 1784, but not to be paid till Christmas-Day sollowing; what is the present Worth, Discount allowed,

at 5 per Cent. per Annum?

7. What is the present Worth of 32201. payable as follows,

1001. at 3 Months, 601. at 5 Months, and the Remainder at 9 Months; Discount at 6 per Cent. per Ann.?

8. Sold Goods to the Value of 4001. to be paid, at three 3 Months, as follows, viz. first \(\frac{1}{3}\), second \(\frac{1}{2}\), and the Rest the third Payment; what is the Discount, and present Worth of the Whole, at 4\(\frac{1}{2}\) per Cent. per Annum?

 What ready Money will discharge a Debt of 3601. due at two 5 Months, that is, ¹/₃ at 5 Months, and the Rest at

10; Discount at 3 per Cent. per Annum?

at 5 per Cent. per Annum for 12 Years, and the Difcount of the same Sum, at the same Rate, and for the same Time?

11. What ready Money will discharge a Debt of 133771.

Discount at 43 per Cent. per Annum?

20. EQUATION of PAYMENTS

Is when feveral Debts are payable at different Times, but is mutually agreed between Debtor and Creditor, that all those several Sums be paid at once, and at such a Time as, that neither Party may be wronged thereby; this is called equating the Time of Payment. The common Rule is as follows.

RULE.

Multiply the Sum of each particular Payment by its Time, then add the Products together, and divide the Sum by the whole Debt, the Quotient (by this Rule) is the equated Time for the Payment of the Whole.

EXAMPLES.

1. B. owes C. 600l. whereof 200l. is to be paid at 3 Months, 150l. at 4 Months, and the Rest at 6 Months; but they afterwards agreed the Whole should be paid at once; required the Time?

2. A. bought of B. a Quantity of Goods, which came to 4601 to be paid in the following Manner, viz. 2001. at 7 Months, and the Rest at 5 Months, but afterwards they they agree to make one Payment of the Whole; I de-

mand the equated Time?

3. C. owes D. a certain Sum, which is to be discharged in the following Manner, viz. ½ at 3 Months, ¼ in 4 Months, and ¼ at 9 Months, but they afterwards agree to have but one Payment of the Whole: the equated Time is required?

4. A Debt is to be discharged thus, viz. # present, # at 4 Months, # at 5 Months, and the rest at 6 Months, what

is the equated Time for the Whole?

5. E. is indebted to F. 2401. which by Agreement is to be paid at 5 Months hence; but E. is willing to pay him 401. down, provided he will give him a longer Time for the Payment of the Remainder, which is agreed on: the Time of Payment is required?

21. SINGLE FELLOWSHIP,

OR

FELLOWSHIP WITHOUT TIME,

Is when two or more Persons join their Stocks, and Trade together: To determine each Person's particular Share of the Gain or Loss, in Proportion to his Principal paid into the Stock, observe the following

RULE.

As the Sum of the feveral Stocks: to the Gain or Loss, : : fo is each Person's Share in the Stock: to his Share of the Gain or Loss.

PROOF.

Add all the Shares together, and that Sum (if right) will be equal to the whole Gain or Loss.

EXAMPLES.

in 801. B. 601. and they gain 281. what is each Man's Share of the faid Gain?

2. Three

2. Three Persons, C. D. and E. trade together, and make a joint Stock of 8241. and in three Years Time they gained as much, and 701 over; C.'s Stock was 3201. D.'s 3401. I demand E.'s Stock, and what each Person gained by trading?

3. Suppose four Merchants, A. B. C. and D. join their Stocks and Trade together, of which A. put in \(\frac{1}{2}\), B. \(\frac{1}{3}\), C. \(\frac{1}{4}\) and D. \(\frac{1}{5}\), but, at the Expiration of 12 Months, they had the Misfortune to lote 1201. what must each

Person suffer of the said Loss?

4. Three Merchants, D. E. and F. in Partnership together, and with one commmon Stock of 400l. they gained as follows, viz. D. 30l. E. 48l. and F. 42l. what was each Man's Stock?

5. Suppose the Money and Effects of a Bankrupt, amounted to 2420l. 17s. 6d. and he is indebted as follows, viz. to A. 1000l. to B. 640l. to C. gool. and to D. 842l. 16s. how must his Effects be divided amongst them, that is, what must each have?

QUESTIONS for Exercise at Leisure Hours.

6. A Father, ignorant in Numbers, ordered 5001 to be divided amongst his five Sons, thus, give A. says he, ¹/₃, B. ¹/₄, C. ¹/₅, D. ¹/₆, and E. ¹/₇: Part this equitably amongst them, according to the Father's Intention?

7. Three Persons purchase together a West-India Sloop, towards which A. advanced 3, B. 1, and C. 1401. how much paid A. and B. and what part of the Vessel

had C.?

8. A. and B. clear by an Adventure at Sea 50 Guineas, with which they agree to buy a Horse and Chaise; whereof they were to have the Use, in Proportion to the Sums adventured, which was found to be A. 10: to B. 7; they cleared 45 per Cent.; what Money then did each send abroad?

9. A. and B. join their Stocks, and veft them in Brandies.

A.'s Stock was 191. 192. 8d. more than that of B.; now by felling out their Commodity at 552. per Anchor, A. cleared 741. 112. and B. just 50 Guineas. The Quantity of Brandy dealt for is required, and the Gain upon

the Anchor?

- venture was 35s. more than B.'s, whose Share of the Profit is but 8s. 6d. what are the Particulars of their Stock?
- which A. contributed 2101. B. 3121. they cleared 1401. whereof 371. 101. belongs of Right to C. That Perfon's Stock, and the feveral Gains of the other two, are required?
- 12. A. and B. venturing equal Sums of Money, clear by joint Trade 1541. by Agreement A. was to have 8 per Cent. because he spent Time in Execution of the Project, and B. was to have only 5. The Question is, what was allotted A. for his Trouble?
- 13. A. B. and C. are three Horses belonging to different Men, and are employed as a Team to draw a Load of Wheat from Hertford for 30s. A. and B. are deemed to do $\frac{2}{7}$ of the Work, A. and C. $\frac{3}{8}$, and B. and C. $\frac{1}{10}$ of it; they are to be paid proportionally, and do you know how to divide it as it should be?
- 14. Bought 100 Quarters of Malt, Meal, and Oat-meal, together, for 1421. For every 5 Bushels of Malt, I had 3 of Meal; for every 8 of Meal, I had 7 of Oat-meal: Pray what did these cost me severally a Bushel, the Malt being half as dear again as the Meal, and the Meal being double the Price of the Oat-meal?
- 15. In raising a joint Stock of 4001. A. advanced 43. B. $\frac{12}{11}$ of $\frac{3}{8}$. C. $\frac{1}{6}$ more; the Difference between A.'s Adventure and B.'s, and D. the rest of the Money; what did every one subscribe?

22. DOUBLE FELLOWSHIP,

OR

FELLOWSHIP WITH TIME,

Is when each Person's Stock continues unequal Time in Company, so that a Consideration must be made of the Time, as well as of the Stock.

RULE.

Multiply each Person's Stock by the Time it has continued in Trade, and proceed with the Products, as with the particular Stocks in Single Fellowship.

PROOF.

As in Single Fellowship.

EXAMPLES.

thus; A. puts into the Stock 2401. for 4 Months, B. 1201. for 6 Months, and C. 2001. for 8 Months; with this joint Stock they traffic and gain 2601. it is required to find each Person's Share of the Gain, proportionable to his Stock and Time of employing it?

2. A Ship's Company take a Prize, Value 40001. which they agree to divide amongst them, according to their Pay and Time they have been on board; now the Officers and Midshipmen have been on board 4 Months, and the Sailors 3; the Officers have 50s. a Month, the Midshipmen 40s. and the Sailors 28s. moreover, there are 4 Officers, 8 Midshipmen, and 120 Sailors: I demand to know what each Person's Share is of the sail Prize?

3. A. B. and C. rent a Piece of Land, for which they pay 40l. per Annum; A. puts in 60 Oxen for 4 Months, B. 40 Oxen for 5 Months, and C. 30 Oxen for the Remainder of the Year; what must each Person pay of the said Rent?

4. Three Merchants, A. B. and C. in Partnership together for a Year, put into one common Stock as follows, viz. A. put in 400l. and at 6 Months End withdraws 200l. B. puts in 360l. and at 7 Months End 100l. more, but at the End of 9 Months he takes out 120l. C. puts in 190l. and at 8 Months End 110l. more, but at the End of 10 Months he takes out 100l. they gain 460l. what is each Man's Share?

QUESTIONS for Exercise at Leisure Hours.

5. A. and B. in Partnership equally divide the Gain; A.'s Money, which was 841. 125. 6d. lay for 19 Months, and B.'s for no more than 7; the Adventure of the

latter is fought?

6. A. for 9 Months Adventure received 201. B. for one of 7 Months received 25 Guineas, and C. for lying out of his Contributions 5 Months, had a Title to 321. The Total of their Adventures multiplied into their respective Times, was 6401. what then were the Particulars?

7. A. clears 131. in 6 Months, B. 181. in 5 Months, and C. 231. in 9 Months, with a Stock of 721. 105. what

then did the general Stock Amount to?

8. X. Y. and Z. in Company, make one common Stock of 42621. X.'s Money was in 4 Months, Y.'s 6 Months, and Z.'s 9 Months, they gained 4201. which was to be divided in the following Manner, viz. ½ of X.'s Gain, to be equal to ¼ of Y.'s, and ¼ of Y.'s Gain to be equal to ¼ of Z.'s. Quere, what each Person gained and put in?

9. A. B. and C. in Company; A. put in his Share of the Stock for 5 Months, and laid Claim to \(\frac{1}{5}\) of the Profits, B. put in his for 8 Months, C. advanced 4001. for 7 Months, and required on the Balance \(\frac{2}{3}\) of the Gain; the Stock of the other two Adventurers is fought?

10. A. and B. paid equally for a Horse, Feb. 7, 1771; A. on the 10th, took him a Journey in the West, and returned on the 10th of June following; B. on the 2d of August took him into Scotland, and stayed till Nov 13, and this concluded his Service for this Year. From Jan. 17th following, A. used him ten Days, and in six Wecks after his Return, employed him till April 30th, B. then rode him from May-day to Midsummer, A. had him from the 14th of July, to 14 Days after St. James's Tide; B. on Sept. 30th, took him into Norsolk, and came back Oct. 19th; he then was sold for 71. 10s. and they would have the Money parted equitably between them, viz. in Proportion to the Use each made of their Steed?

23. BARTER.

23. BARTER

Is the changing of one Commodity for another, and informs us how to Proportion the Value of any Goods, fo that neither Party may fustain Loss. And if the Commodities exchanged are not of equal Value, the Desect is supplied with Money.

RULES.

1. Find the Value of that Commodity, whose Quantity is given, then find what Quantity of the other, at the given Rate, you can have for the aforesaid Value, which Quantity will be the Answer.

2. When one has Goods at a certain Price ready Money, but in Barterage advances it to fomething more, fay, As the ready Money Price of the one: is to its Bartering Price: fo is the ready Money Price of the other to its Bartering Price; then the Quantity of the latter Commodity may be found either from the ready Money, or Bartering Price.

EXAMPLES.

- 1. How much Sugar, at 11. 10s. per cwt. must be given in Barter, for 4 cwt. of Tea, at 12s. per Pound?
- 2. How many Yards of Cloth, at 18s. per Yard, must I give for 45 Yards of Shalloon, at 16d. per Yard?
- 3. A. and B. Barter: A. hath 30 cwt. of Prunes, at 6d. per lb. ready Money, but in Barter will have $7\frac{1}{2}d$. per lb. B. hath Hops worth 36s. per cwt. ready Money; what ought B. to rate his Hops in Barter, and what Quantity must be given for the 30 cwt. of Prunes?

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4. A. hath Tea at 8s. 6d. per lb. ready Money, but in Barter will have 10s. per lb. B. hath Tobacco worth 18d. per lb. ready Money; how must B. rate his Tobacco per lb. that his Profit may be equivalent with A.'s?

QUESTIONS for Exercise at Leisure Hours.

5. A. has Currants worth 4d. per lb. but in Truck charges 6d. and also requires one Half of that in ready Money; B. has Candles worth 6s. 8d. the Dozen, and he in Barter, honest Man, charges but 7s. Should these Persons deal together for the Value of 20l. how much

will A. have got of B.?

6. A. lets B. have a Hogshead of Sugar, Weight 18 cwt. worth 31s. for 42s. per cwt. one-third of which he is to pay in Cash; B. hath Paper worth 14s. the Ream, which it is agreed shall bear no more than 15s. 6d. at that Rate, and Truck for the Rest: how stood the Account?

7. A. has Kerseys at 41. 55. a Piece, ready Money; in Barter they are charged by him at 51. 65. each, and ½ of that required down: B. has Flax at 3d. per lb. how ought he to rate it in Truck, not to be hurt by the

Extortion of A.?

8. A. has 50 Broad Cloths, at 111. 10s. a Piece, but in Change required 131. taking Wool, at 2s. 6d. per Stone, of B. in return, that was really worth but 4s. 2d. a Tod: The Question is, how many Sacks of Wool will pay for the Cloth, and which of the Dealers has the better in the Bargain?

9. A. with an Intention to clear 30 Guineas on a Bargain with B. rates Hops at 16d. per lb. that stood him in 10d. B. apprized of that, set down Malt, which cost 20s. a Quarter, at an adequate Price; how much Malt

did they contract for?

10. A. in order to put off to B. 720 Ells of damaged Holland, worth 5s. an Ell, at 6s. 8d. propose, in Case he has Half the Value in Money, to give B. thereon a Discount of 10 per Cent. the rest A. is to take out in Saffron, which B. apprized of the whole Management, rates in Justice at 30s. the Pound; pray what was it really worth in ready Money, and what Quantity of Saffron was he to deliver on the Change?

in Barter he fets down at 10s. B. fenfible of this, has Pamphlets at 6d. a Piece ready Money, which he adequately charges, and infifts, besides, on $\frac{1}{4}$ of the Price

of those he parts with in Specie; what Number of the Books is he to deliver in Lieu of A.'s Paper, what Cash will make good the Difference, and how much is B. the Gainer by this Affair?

12. A. and B. Barter; A. has 140 lb. 11 oz. of Plate, at 6s. 4d. the Ounce, which in Truck he rates at 7s. 2d. an Ounce, and allows a Difcount on his Part, to have \(\frac{1}{7}\) of that in ready Specie; B. has Tea worth 9s. 6d. the lb. which he rates at 11s. 2d. When they come to strike the Balance, A. received but 7 cwt. 2 qrs. 18 lb. of Tea: Pray what Difcount did A. allow B. which of them had the Advantage, and how much, in an Article of Trade thus circumstanced?

13. A. and B. Truck; A. has 14 cwt. 2 qrs. 25 lb. of Farnham Hops, at 21. 19s. per cwt. but in Barter infifts on 3 Guineas; B. has Wine worth 6s. per Gallon, which he raises in Proportion to A.'s Demand on the Balance; A. received but a Hogshead and a Half of Wine: Pray what had he in ready Money?

24. LOSS and GAIN

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leice of Is a Rule by which we discover the Gain or Loss by any Parcel of Goods, and so instructs us how to raise or fall the Price of any Commodity in such Proportions, that neither our Gain may be so exorbitant as to injure our Customers, nor our Loss so great as to impoverish ourselves; which is generally at so much per Cent.

In this Rule there are great Variety of Examples, all of which may be easily folved (with a little Consideration) by

When the Quantity lost and gained of the Whole is given, to find the Value of any Part thereof.

RULE.

Say, As the whole Quantity of Goods: is to the Sum of the whole Cost and proposed Gain:: so is any Part of said Goods: to the Price they must be fold for.

When the proposed Gain or Loss is at so much per Cent. make 100l. with the Gain or Loss added to it, your 2d Term.

EXAMPLES.

1. Bought 240 Yards of Cloth, at 14s. 6d. per Yard, and fold it again at 18s. per Yard. What did I gain by the Whole?

2. Suppose I give 461. for 9 cwt. 2 qrs. 18 lb. of Sugar, at what Rate must I sell it at per lb. to gain 12 Guineas

by the Whole?

3. If I buy Tea at 8s. 6d. per lb. and fell it again for 10s. 6d. what is the Gain per Cent.?

The five following Examples, in the Authors mentioned, are wrong answered, which is the Reason of my inserting them here;—the Error consists in the stating the Question, by making the Gain or Loss of 1001. the 2d Term, instead of its Amount.

4. If by felling Cloth at 5s. per Ell, I gain 8l. per Cent. what shall I gain per Cent. if I sell the Ell at 6s. 3d.? (Webster, 2d Ed. p. 32.)

fhall I gain per Cent. if I fell the Dozen at 5s. od.?

(Stonebouse, 2d Edit. p. 103.)

6. A Manchester Tradesman going to a Fair, sold Fustians for 11s. 6d. the End, wherein was gained 15l. per Cent. but seeing no other Tradesman had so good, raised them, at the latter End of the Fair, to 12s. the End; I demand what he gained per Cent. by this last Sale? (Hill, p. 289.)

7. Suppose I sell 500 Deals at 15d. per Piece, and 9l. per Cent. Loss; what do I lose by the whole Quantity?

(Dilworth, 2d Edit. p. 73.)

8. Suppose I sell I cwt. of Hops for 61. 155. and Gain 251. per Cent. what would have been the Gain per Cent. if I had sold them for 81. per Cent.? (Wolkingham, 3d Edit. p. 70.)

9. If by felling Hops at 31. 10s. per cwt. the Planter clears 30 per Cent. what was his Gain per Cent. when the

fame Goods fold for 41. and a Crown?

ing lost 17 per Cent. whereas I ought in dealing to have cleared

cleared 20 per Cent. then how much was it fold under the just Value?

QUESTIONS for Exercise at Leisure Hours.

- II. If by fending Pewter to Turkey, and parting with it at $35\frac{2}{3}d$. per lb. the Merchant clears Cent. per Cent. what does he clear in Holland, where he disposes of the cwt. for 81.?
- 12. Bought Hose in London, at 45. 3d. the Pair, and sold them afterwards in Dublin at 6s. the Pair; now taking the Charges at an Average to be 2d. the Pair, and considering that I must lose 12 per Cent. by remitting my Money home again, what do I gain per Cent. by this Article of Trade?
- 13. If my Factor at Leghorn return me 800 Barrels of Anchovies, each weighing 14 lb. Net, worth 12½d. per lb. in lieu of 7490 lb. of Virginia Tobacco, and if I find that I have gained after the Rate of 17l. per Cent. by the faid Confignment, pray how was my faid Tobacco invoiced per lb. to the Factor, that is, what was the prime Coft?

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- 14. Bought Comfits to the Value of 411. 3s. 4d. for 3s. 1d. per lb. it happened, that so many of them were damaged in Carriage, that by felling what remained good, at 4s. 6d. per lb. my Returns were no more than 34l. 2s. 6d. Pray how much of these Goods were spoiled, and what did this Part stand me in?
- 15. A Stationer fold Quills at 115. per Thousand, by which he cleared \(\frac{3}{8}\) of the Money; but they growing scarce, raised them to 135. 6d. per Thousand: What might he clear per Cent. by the latter Price?
- 16. A. had 15 Pipes of Malaga Wine, which he parted with to B. at $4\frac{1}{3}$ per Cent. profit, who fold them to C. for 381. 11s. 6d. Advantage; C. made them over to D. for 5001. 16s. 8d. and cleared thereby $6\frac{1}{2}$ per Cent. what did this Wine cost A. per Gallon?
- 17. Laid out in a Lot of Muslin 4801. 125. upon Examination of which, two Parts in seven proved damaged; so that I could make but 55. 6d. a Yard of the same; and by so doing, find I lost 481. 185. by it, at what

Rate per Ell am I to part with the undamaged Muslin, to make up my faid Loss?

25. ALLIGATION MEDIAL

Is when the Price and Quantity of feveral Commodities are given to be mixed, to find the mean Price of that Mixture,

RULE.

As the whole Composition: is to its total Value:: so is any Part thereof: to its mean Price.

PROOF.

Find the Value of the whole Mixture at the mean Rate, and if it agrees with the Total Value of the feveral Quantities at their respective Prices, the Work is right.

EXAMPLES.

1. A Wine-Merchant mingles 14 Gallons of Mountain Wine, at 8s. per Gallon, with 12 Gallons at 6s. per Gallon, 10 Gallons of Sherry at 7s. per Gallon, 20 Gallons of White Wine, at 4s. per Gallon, and 8 Gallons of Canary, at 9s. per Gallon: How may he fell this Mixture per Gallon?

2. With 13 Gallons of Canary, at 6s. 8d. a Gallon, I mingled 20 Gallons of White Wine, at 5s. a Gallon; and to these add 10 Gallons of Cyder, at 3s. a Gallon: At what Rate must I sell a Quart of this Mixture, so as to

clear 10 per Cent.?

26. ALLIGATION ALTERNATE

Is when the Rates of several Commodities are given, to find such Quantities of them, as being mixed together shall bear a Price propounded.

RULES.

T. The Rates (if not already) must all be reduced to one Denomination.

2. Set down the Rate, or Prices, in a Column under one another, and the mixed or mean Rate on the left Hand of these.

3. Connect or link together the feveral Rates, so that every one less than the mean, be linked with some one greater, or with as many as you please, that are greater, and every great with one less, or with as many less as you

pleafe.

4. Take the Difference between each Price and the mean Rate, and fet them alternately, and if only one Difference stand against any Rate, it will be the Quantity belonging to that said Rate; but if there are several, then their Sum will be the Quantity, which Quantities are the Answer for that Rate, against which they stand.

EXAMPLES.

3. To mix Gold of 18 Carrats fine with that of 23 Carats fine, of 19, and of 16 Carats fine, fo that the Compofition may be 20 Carats fine; what Quantity of each must be taken?

4. A Grocer would mix a Quantity of Sugar at 10d. per lb. with other Sugars, at $7\frac{1}{2}d$. 5d. and $4\frac{1}{2}d$. per lb. intending to make up a Commodity worth 6d. per lb. In

what Proportion is he to take of those Sugars?

27. ALLIGATION PARTIAL

Is when the Price of each Simple is given, also the Quantity of one of them, and the mean Rate, to find the several Quantities of the Rest in Proportion to that given.

RULES.

1. Take the Difference between each Price and the mean Rate as in the last Rule.

2. As

2. As the Difference of that Simple, whose Quantity is given: is to the known Quantity: fo is any other Difference: to the Quantity of its opposite Name.

EXAMPLES.

5. How much Tea at 6s. 6d. 7s. 6d. and 9s. per lb. must be taken to be mixed with 36 lb. at 12s. per lb. that

the Mixture may be worth 8s. per lb.?

6. A Tobacconist has by him 120 lb. of fine Oroonoko Tobacco, worth 25. 6d. a Pound; to this he would mix York-River ditto at 20d. and other inferior Tobaccos at 18d. and 15d. a Pound, as will make up a Mixture answerable to 25. a Pound: What will this Parcel weigh?

28. ALLIGATION TOTAL

Is when the Price of each Simple is given, as also the mean Rate, and what Quantity of the Compound, to find how much of each Sort will make that Quantity.

RULES.

1. Take the Difference between each Price, and the mean Rate as before.

2. Say, as the Sum of these Differences: is to the whole Quantity of the Mixture: fo is each particular Difference: to its particular Quantity.

EXAMPLES.

7. How much Gold of 16, of 18, and 23 Carats fine, must be mixed together, to form a Composition of 60 oz. of 20 Carats fine?

8. A Druggist has by him 4 Sorts of Green Tea, viz. of 5s. 6s. 8s. and 9s. per lb. out of these he is inclined to mix up a Cannister, containing Net a Hundred and a Half, so as to make the Commodity worth 7s. the Pound. In what Proportion must those Teas be taken?

29. EXCHANGE

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Is the receiving in one Country for the Value paid in

The Par of Exchange is always fixed and certain, it being at the intrinsic Value of any foreign Money compared with Sterling, but the Course of Exchange between any two Countries rises and falls upon various Occasions.

But as it would be both needless and endless to write of every Kind of Exchange; fo I shall only give a few Examples of the Exchange of England, with some of the chief Countries of Europe.

Exchange is either performed by Sect. 12, or 15, and fometimes most expeditious by the latter.

Ift. With FRANCE.

They keep their Accounts at Paris, Lyons, and Rouen, in Livres, Sols, and Deniers, and Exchange by the Crown of three Livres Tournois, or 60 Sols French, and give Pence Sterling, more or less, for this Exchange Crown, which is equal to 4s. 6d. at Par.

12 Deniers
20 Sols
3 Livres make one Sol.
Crown.

1. To change French Money into Sterling.

RULE.

As I Crown: is to the given Rate: fo is the given French Sum: to the Sterling required; or by the Rules given in Practice.

2. To change Sterling Money into French.

RULE.

As the Rate of Exchange: is to 1 Crown: fo is the Sterling Sum: to the French required.

Note.—The fame Rule must be observed with most of the following Countries.

EXAMPLES.

EXAMPLES.

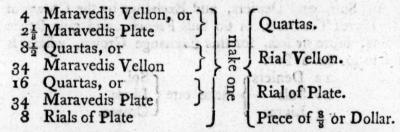
- 1. What Sterling Money must be paid in London, to receive in Paris 500 Crowns; Exchange at 56d. per Crown?
- 2. How many Crowns must be paid at Paris, to receive in London 1161. 135. 4d. the Exchange at 56d. per Crown?

3. Change 640 Crowns, 12 Sols, 8 Deniers, at 54½d. per Crown, into Sterling?

4. Change 1451. 7s. $7\frac{1}{2}d$. Sterling, into French Crowns, Exchange at $54\frac{1}{2}d$. per Crown?

2d. With SPAIN.

They keep their Accounts at Madrid, Cadiz, and Seville, in Dollars, Rials, and Maravedis, and exchange by the Piece of Eight, which is equal to 45. 6d. at Par.



N. B. A Rial Vellon is $\frac{17}{32}$ of a Rial of Plate, and $\frac{17}{256}$ of a Piaster.

EXAMPLES.

5. Change 8561. 6s. 8d. into Spanish Money, Exchange at 56d. per Piece of Eight?

6. If I pay in Seville 1426 Pieces of \$\frac{8}{8}\$, 4 Rials, 26 Maravedis, what may I draw for my Bill at London, Exchange at 54\frac{1}{4}d. per Piece of \$\frac{8}{8}\$?

3d. I T A L Y.

In Italy they keep their Accounts at Genoa and Leghorn, in Livres, Sols, and Deniers, and exchange by the Piece of Eight or Dollar, which is equal to 4s. 6d. at Par.

12 Deniers

12 Deniers
20 Sols
5 Livres
6 Livres
Piece of \$\frac{8}{8}\$ at \$\frac{\text{Genoa.}}{\text{Leghorn.}}\$

At Florence the Exchange is by Ducatoons, and at Venice by Ducats, divided as follows, viz.

6 Solidi make one Gross.

6 Solidi 24 Groffes make one Ducat

EXAMPLES.

7. Genoa is indebted to London 640 Dollars, for how much Sterling may London value on Genoa, the Exchange at 52d. per Dollar?

8. If a Merchant remits 1381. 135.4d. Sterling to Leghorn, how many Dollars will he receive there, the Exchange

at 52d. per Dollar?

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Note.—In St. George's Bank at Genoa, Accounts are kept in Piasters or Pezzoes, which are divided into Solidi and Denarii, as the Pound Sterling.

But some Merchants keep their Accounts in Lires, or Liras, Solide, and Deanre, divided, as before: This Money is only one Fifth in Value of the Bank Money.

9. Change 8644 Pez. 25. 6d. into Sterling Money, Ex-

change at 47 d. per Pezzoe?

10. London is indebted to Genoa in 17101. 16s. 4d. or how many Pezzoes may Genoa value on London, the Exchange at 47½d. per Pez.?

4th. With PORTUGAL.

They keep their Accounts in Lisbon, Oporto, &c. in Reas, and Exchange on the Milrea, which London gives from 5s. to 5s. 6d. for the same.

400 Reas make one Crusadoe. Milrea.

EXAMPLES.

11. A Merchant at Lisbon being desirous to remit to his Correspondent in London 4760 Milreas, Exchange at 64d. per Milrea, how much Sterling must be paid in London?

12. How

12. How many Milreas will 15661. 6s. 8d. amount to, Exchange at 64d. per Milrea?

5th. With HOLLAND, FLANDERS, and GERMANY.

In these Places, their Accounts are kept sometimes in Pounds, Shillings, and Pence, as in England, and sometimes in Guilders, Stivers, and Pennings. The Money of Holland and Flanders, is distinguished by the Name of Flemish, and the Exchange is made with London, from 30 to 38 Shillings Flemish, per £. Sterling.

8 Pennings	CH TELL	Groat.
2 Groats		Stiver.
6 Stivers	added to its	Shilling. die oor .
20 Stivers		Florin, or Guilder.
2½ Florins		Rix Dollar.
6 Florins	P M	Pound Flemish.
5 Guilders		Ducat.
SACRET TO THE PARTY OF THE	LILLO WILLS	CODELLY NOW ACTUALLY

To change Flemish Money into Sterling; and, on the contrary, Sterling into Flemish, is the same with that of France, only what was French there, will be Flemish here.

To reduce Flemish Pounds, Shillings, and Pence, into Guilders.

n for the Bang grad U R. Correct TV

Reduce them into Pence Flemish, then divide by 40, (because 40d. is equal to one Guilder) and the Quotient will be Guilders; and the Remainder (if any) divide by 2, because 2d. is equal to one Stiver) and the Quotient will be Stivers.

EXAMPLES.

13. A Merchant in Rotterdam remits 5641. 10s. 6d. Flemish, to be paid in London, how much Sterling Money must he draw for, Exchange at 34s. 4d. per £. Sterling?

14. Suppose a Merchant delivered in London 3281. 165.

113d. to receive the Value at Amsterdam in Flemish
Money; how many Pounds must be receive there, the
Exchange at 34s. 4d. Flemish per £. Sterling?

15. What may I draw my Bill for to London, if I pay in Antwerp 4200 Guilders, 12 Stivers, 8 Pennings, Exchange at 33s. 3d. Flem. per £. Sterling?

16. If I pay in London 4211. 2s. 3d. how many Guilders may I draw my Bill for at Antwerp, Exchange at 33s. 3d. Flem. per £. Sterling?

17. Exchange 2421. 13s. 6d. Flemish into Guilders, Stivers, &c.

6th. To Change CURRENT MONEY into BANCO.

RULE.

As 100 with the Agio added to it: is to 100 Banco:: fo is any given Sum current: to the Banco required.

E 'X A M P L E.

18. Change 495 Guilders, 18 Stivers Current, into Banco Florins, Agio 5 per Cent.

To Change Banco into Current Money.

RULE.

As 100 Guilders Banco: is to 100 with the Agio added to it:: fo is the Banco given: to the Current required.

EXAMPLE.

19. Change 470 Guilders, 8 Stivers Banco into Current, Agio at \$ per Cent.

Note.—The Bank Money is worth more than the Current, their Difference is called Agio, and is from three to 6 per Cent. in Favour of the Bank.

7. With VENICE.

Money of Exchange here is always understood to be that of Ducats in Bank, which is imaginary, 100 whereof make 120 Ducats Current Money; so that the Difference betwixt Bank and Current Money is an Agio of 20 per Cent. though the Brokers have invented another Agio to be added, which is more or less according to Bargain.

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The Course of Exchange of a Ducat of the Bank of Venice is from 45d. to 50d. Sterling.

E XAMPL

20. Venice draws on London for 4700 Ducats, 10 Sols, 8 Den. Banco, Exchange at 47 g per Ducat, how much Sterling will pay the Draught? A. Flemain, per

With POLAND and PRUSSIA. 8th.

Dantzick and Kenigsberg Exchange with London by Way of Amsterdam and Hamburgh; 270 Polish Grosch being 11. Gross Banco in Holland; 110 Polish Grosch being= r Rix-Dollar, Banco of Hamburgh.

18	Phenningen) Hoy	Grofch. Shalqqui aya von
3	Grosch		Ditkin.
2	Ditkins	8	Sixer. Stored to 49 8 1
3	Sixers	(2)	Tymph. at sadded a
75	Grofch Grof Grof	703	Arch de Halber.
4	Arch de Halbers	1 3	Florin of Guilder. 300000
	Florins or Gilders	14 755 2	Current] D. II
4	Guilders I I	4 1	Current Dollar.

Sechange at 12 per Cynt, how much Steiling S.

21. Change 4684 Florins into Sterling Money, 270 Grofchi Poli, per Pound Flemish, and 34s. 4d. Flemish, per f. Sterling ?besties of nonno. I flum diel down we

22. Change 3901. Sterling into Florins, the Exchange being 335. 4d. Flemish, per L. Sterling, and 270 Groschi
Poli, per f. Flemish, and ANT MARKET AND ANTERIOR

other With RIUSS IMA. aga douch al ties, Accounts are kept, and the Money divided, as a

3 Copecs		Altine.
To Copecs	la basilan al	Grievener.
Four pras Copecs	oil subduced	Polpoliton.
Polpolitons	make one	Poltin.
2 Poltins	Anter House	Rubble.
2 Rubbles		Ducat.

The Ruffian Rubbles are converted into Florins Current Money of Amsterdam, and the Current into Bank Money, according

according to the Agio of three or five per Cent. and Bank Money into Sterling, according to the Course of Exchange between England and Amsterdam.

XAMPLE.

23. In 6420 Rubbles, 42 Copecs, Exchange 122 Copecs per Rix-Dollar current, Agio 3 per Cent. and 34s. 6d. Flemish, per f. Sterling, how much Sterling Money ? 2 U A 9 bas C M A J O g .

10th. With IRELAND.

In Ireland they keep their Accounts in f. s. and d. Irish, divided as in England; but having no Coins of their own, they are supplied by the different Countries with which they traffic.

The Par of Exchange between England and Ireland, is 1001. Sterling, for 1081. 65. 8d. Irish, or 1s. English=13d.

The Course of Exchange is from 5 to 12 per Cent. according to the Balance of Trade. Arch de Halbers

Floring of Gilders | Current Dellar Guilde Z I | Q MS | Aie X E

24. Dublin draws upon London for 740l. 14s. 6d. Irish, Exchange at 12 per Cent. how much Sterling must London pay Dublin to Discharge this Bill?

25. London remits to Ireland 6511 145. 117d. Sterling; how much Irish must London be credited, Exchange at Change 3902 Sterling into I brills, Mans jeg 2 1 1

11th. With AMERICA and the WEST INDIES.

Flemith, per E. Sterling, that 270 Giodia

In Exchange with our Colonies in America and the West Indies, Accounts are kept, and the Money divided, as in England; their Money is called Currency.

The Scarcity of Cash obliged them to substitute a Paper-Currency for carrying on their Trade; which being subject to Cafualties, fuffer a very great Difcount for Sterling, in the Purchase of Bills of Exchange. I be Bule & to der en gelkubblos Veyle, ut gafa. Thancaker f. See:

word imaginating the participation of EXAMPLES.

EXAMPLES.

26. Philadelphia is indebted to London 14741. 16s. Currency, what Sterling may London reckon to be remitted, when the Exchange is 64 per Cent.?

27. London receives a Bill of Exchange from Philadelphia, for 9436, 175. 5\frac{1}{6}. Sterling; for how much Currency was London indebted, Exchange being at 64 per

Cent.?

28. London configus to Jamaica Goods, per Invoice, amounting to 6401. 16s. 3d. which are fold for 3871. 12s. Currency; what Sterling ought the Factor to remit, deducting 5 per Cent. for Commission and Charges; and what does London gain per Cent. upon the Adventure, supposing the Exchange at 30 per Cent.?

29. Jamaica is indebted to London 14701. 125. 8d. Sterling; with how much Currency will London be credited at Jamaica, when the Exchange is 36½ per

... Cept. ? ... de dag and sent of balus wire A one

A few Examples for Exercise in this Rule.

30. Amsterdam changes on London 34s. 4d. per £. Sterling, and on Lisbon at 52d. Flemish, for 400 Reas; how then ought the Exchange to go between London and Lisbon?

and Lilbon?

31. A. at Paris draws on B. of London 1200 Crowns, at 55d. Sterling per Crown; for the Value whereof, B. draws again on A. 56d. Sterling per Crown, hefides Commission & per Cent. Did A. get or lose by this

Transaction, and what?

72. V. of Amsterdam draws on X. of Hamburgh, at 67d. Flem. per Dollar, of 32 Sols Lubeck; and on Y. of Nuremberg, at 70d. Flemish per Florin, of 65 Crutzers Current: If V. has Orders to draw on X. in order to remit to Y. at the said Prices, how would run the Exchange between Hamburgh and Nuremberg?

33. M. of Amsterdam orders N. of London to remit O. of Paris at 54d. Sterling per Crown, and to draw on P. of Antwerp for the Value, at 33½s. Flem. per £. Sterling; but as soon as N. received the Commission, the Exchange was on Paris, at 54½d. per Crown: Pray at

what

cute his Orders, and be no lofer?

34. London changes with Amsterdam on Par at 335. 4d. Flem. per f.; Amsterdam changes on Middleburg, at 2 per Cent. How stands the Exchange between London

and Middleburg?

35. Q. of Rotterdam remits to R. of Paris 2000 Crowns, at 91d. Flem. per Crown, and double Usance, or two Months, and pays 30 per Cent. Brokerage, with Orders to remit him again the Value, at 93d. per Crown, allowing at the same Time 12 per Cent. for Provision: What is gained per Cent. per Annum, by a Remittance

thus managed?

36. A. of Amsterdam owes B. of Paris 2000 Florins of current Specie, which he is to remit him, by Order, the Exchange at 90½d. Flemish per Crown, of 60 Sols Tournois, the Agio of the Bank being four per Cent. better than Specie; but this, when it was to be negociated, the Exchange was down at 80½d. per Crown, and the Agio raised to five per Cent. what did B. get by this Turn of Affairs?

29. Comparison of WEIGHTS and MEASURES

Is when the Weights or Measures of different Countries are compared together, and is a very necessary Rule (of great Importance to the Merchant) to be acquainted with.

1. When it is required to find how many of the first Sort (of Weight or Measure mentioned in the Question) are equal to a given Quantity of the last.

R U L E S.

- 1. Place the Numbers alternately, beginning at the Left-Hand, and let the last Number stand on the Left-Hand.
- 2. Multiply the first Rank continually together for a Dividend, and the second for a Divisor.

EXAMPLES.

1. If 100 lb. of London are equal to 113 lb. of Marseilles, and 100 lb. at Marseilles, are equal to 81 lb. of Amsterdam; how many Pounds at London are equal to 60 lb. of Amsterdam?

2. If 104lb. of English are equal to 8½lb. of Geneva, and 100lb. of Geneva are equal to 108lb. at Rouen; how many Pounds English are equal to 64lb. of

Rouen?

3. Suppose 100 yds. English to be equal to 78 Ells French, and 78 Ells French are equal to 133 Ells at Amsterdam; how many Yards English are equal to 100 Ells at Amsterdam?

4. If 100 Canes of Genoa be equal to 1913 Ells of England, and 78 Ells of Eng. be equal to 1313 of Bruffels, how many Canes of Genoa are equal to 100 Ells of Bruffels?

When it is required to find how many of the last Sort (of Weight or Measure mentioned) are equal to a given Number of the First.

o and the trace of the by this Proportion, with

1. Place the Numbers alternately, beginning at the Lest-Hand (as before) and set the last Number on the Right-Hand.

2. Multiply the first Row for a Divisor, and the other for

a Dividend.

EXAMPLES.

serees with the cived Muinder, it is tight

5. Suppose 100 lb. of Portugal be equal to 92 lb. of Antwerp, and 100 lb. of Antwerp, be equal to 110 lb. of Lyons; how many Pounds at Lyons are equal to 60 lb. of Portugal?

6. If 74 Yards of English be equal to 100 Brasses of Florence, and 100 Brasses of Florence be equal to 30 Canes of Marseilles; how many Canes of Marseilles

are equal to 100 Yards English?

30. POSITION,

OR

mobile to a

The RULE of FALSE,

Is so called, because we suppose some uncertain or false Numbers, in order, that by reasoning from them, according to the Nature thereof, do, by those salse supposed Numbers, find the true Number sought.

This Rule is divided into two Parts, commonly called the Single Rule, and Double Rule.

SINGLE POSITION.

By Single Position are answered all such Questions, as require only one Supposition to discover the true Result.

RULE.

Make choice of your Position, work with that Supposition, according to the Nature of the Question, as if it were the true Number, and if you find (after ordering your Position) the Result either too much or too little, you may then find the true Answer, by this Proportion, viz.

As the Refult of your Position: is to the Position: fo is the given Number: to the Number sought.

P R O O F.

Add the several Parts of the Sum together, and if the Sum agrees with the given Number, it is right.

EXAMPLES.

1. Three Perfons, A. B. and C. discoursing concerning their Ages, says B. to A. I am as old and half again as old as you: then says C. to B. I am twice as old as you; now says A. to them both, I am sure, if our Ages be added together, the sum will be 132. I demand each Man's Age?

2. A Man, overtaking a Maid driving a Flock of Geese, said to her, How do you do, Sweetheart? Where are

you going with these 40 Geese? No, Sir, said she, I have not forty, but if I had as many more, half as many more, and 10 Geese besides, I should have 40.

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t

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How many Geefe had she?

3. A. B. C. and D. were in Company together; A. told C. that he was older than him by 4 Years; B. told them, that he was as old as both of them together, and 9 Years older; D. hearing them, faid, I am just 45 Years old, and that is equal to the Sum of your Ages added together. How old was each of them added together? How old was each of them feverally?

4. Three Persons, viz. Andrew, Benjamin, and Christopher, are to go a Journey of 469 Miles; of this Journey, Andrew is to go a certain Number of Miles unknown; Benjamin is to go three Times as many Miles as Andrew, and one League more; and Christopher is to go twice as many Miles as Benjamin, and 16 Miles more. How many Miles must each of these Persons

travel feverally?

5. Admit three Merchants, A. B. and C. to build a Ship, which cost them 2000. of which A. pays a certain Part unknown; B. paid 3½ as much, wanting 451. 155. and C. paid as much as both A. and B. together, and 261. 105. more. How much did each Person pay?

6. I have a Cistern, with three unequal Cocks, containing 60 Pipes of Water, the greater Cock will empty the Cistern in one Hour, the second in two, and the third in three. In what Time will they empty the Cistern,

fuppoling they all be fet open at once?

7. A General being asked the Number of Men his Army consisted of, answered that \(\frac{1}{2}\) amounted to 900. What Number of Men had he?

8. A Schoolmaster was asked how many Scholars he had, answered, If I had as many, ½ as many, ¼ as many, and ½ as many, I should have 383. How many had he?

31. DOUBLE OP SITI

Is when two Suppositions are justed; and if we miss in both (as it generally happens) observe the Nature of the Errors, whether they be greater or less than the given Number, and accordingly they must be made use of thus.

RULES.

have not forty. ist a Lindy salety man, half as

1. Place the Error against its respective Position, and multiply them cross-wife and a saw of bas O. S. A.

2. If the Errors are alike, that is, both greater, or both lefs, than the given Number, take their Difference for a Divisor, and the Difference of their Products for a Dividend to the Difference of their Products for a Dividend to the both states of their Products for a Dividend to the both states of the both states

But if unlike, that is, one too much, and the other too little, then take their Sum for a Divisor, and the Sum of their Products for a Dividend, the Quotient will be the Answer. The color to various and the color radio.

Mynam East TA M P L E S

- r. A Gentleman hath two Horses of good Value, and a Saddle worth 501. which if set on the Back of the first Horse will make his Value double that of the second: but if set on the Back of the second Horse makes his Value triple of that of the first Horse. I demand the Value of each Horse?
- 2. Double my Money for me, faid A. to B. and I will give thee 6d. out of the Stock; with the Remainder he applied in the like Manner to C. with equal Success, and gave him also 6d. he repeated this Proposal to D. and then 6d. was all he had to give. Pray, what Sum had he to begin with?
- gether, the Money staked was 112 Guiness, but disagreeing, each seized as many as he could; A. got a certain Quantity, B. as many as A. and 16 more; but C. got only a 6th Part of their Sum; how many had each?
- 4. A Boy stealing Apples was taken by Mad Tom, and to appease him gives half he had, and Tom gives him back 10; in his return home he was met by Raving Ned, who took from him one Half of what he had lest, and gave him back 4; after that, unlucky Positive Jack meets him, when he gave him one Half of what he had lest, and he returns him back 1: at last getting safe away he finds he has 18 lest. How many had he at first?

5. A Son asked his Father how old he was; his Father replied, Your Age is now 1 of mine; but 4 Year's ago, your Age was only 1 of what mine is now. What were their Ages?

6. There is a certain Fish, whose Head is nine Inches long, the Tail as long as the Head and half the Body, and the Body is as long as both the Head and the Tail. I demand the whole Length of the faid Fish?

7. To find a Number, which if added to itself and the Sum multiplied by the fame, and the fame Number till fubtracted from the Product : and, lally, the Remainder divided by the fame, that it may produce 13.

QUESTIONS for Exercise at Leisure Hours.

8. When first the Marriage-Knot was ty'd Betwixt my Wife and me,

My Age did her's as far exceed 1931000 1910161 add

As three Times three does three; double below But when ten Years, and Half ten Years,

We Man and Wife had been,

Her Age came up as near to mine As eight is to fixteen. of them were indebted to

Now, tell me, I pray,

What were our Ages on the Wedding Day?

9. A Gentleman finding feveral Beggars at his Door, gave to each Fourpence, and had Sixteen Pence left; but if he had given to each Sixpence, he would have wanted Twelve Pence. How many Beggars were there?

10. To find a Number, which being multiplied by 3, fubtract 5 from the Product; and the Remainder divided by 2, if the Number fought he added to the Quotient,

that the Sum may be 40.

11. Two Companions have got a Parcel of Guineas; fays A. to B. if you will give me one of your Guineas, I shall have as many as you will have left. Nay, replies B. if you will give me one of your Guineas, I thall have twice as many as you will have left. How many Guineas had each of them?

12. A Son afked his Father how old he was? his Fathen answered

answered him thus: If you take away 5 from my Years, and divide the Remainder by 8, the Quotient will be a of your Age; but if you add 2 to your Age. and multiply the Whole by 3, and then fubtract 7 from the Product, you will have the Number of the Years of my Age. What was the Age of the Father and Son?

13. Two Men have a mind to purchase a House rated at 1200l. fays A. to B. if you give me 3 of your Money, I can purchase the House alone; but says B. to A. if you will give me 3 of your's, I shall be able to purchase the House. How much Money had each of them?

14. Suppose the Number 50 was to be divided into two Parts, fo the greater Part being divided by 7, and the lesser multiplied by 3, the Sum of this Product, and the former Quotient, may make the fame Number pro-

posed, which was 50.

15. A certain Man hires a Labourer on this Condition, that for every Day he worked be should receive 12 Pence, but for every Day he was idle he should be mulcted 8 Pence: When 390 Days were past, neither of them were indebted to one another. How many Days did he work, and how many was he idle?

16. A Person being asked how old he was, answered, If I quadruple 3 of my Years, and add 5 of them 150 to the Product, the Sum will be so much above 100 as the

Number of my Years is now below 100.

17. A certain Person bought two Horses, with the Trappings, which cost 1001. which Trappings, if laid on the first Horse A. both the Horses will be of equal Value; but if the Trappings be laid on the other Horse, he will be double the Value of the first. How much did

the Horses and Trappings cost?

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18. A young Gentleman, at the Age of 21 Years, was told by his Guardian, that his Fortune confisted in Cash, to the Amount of 7400l. and that his Father died when he was but to Years old, and the Money your Father left, faid the Guardian, I have allowed you 5 per Cent. per Ann. for simple Interest, only I have deducted 1001. per Ann. for your Education, &c.

What was the Son's Fortune that was left by the Father?

32. PROGRESSION

Confifts of two Parts.

ARITHMETICAL and GEOMETRICAL.

ARITHMETICAL PROGRESSION

Is when a Rank or Series of Numbers increase or decrease by a common Difference, or by a continual adding or fubtracting some equal Numbers.

1,2,3,4,5,6,7,8, Here the common Difference is 1.

Alfo35,30,20,22,15,10,5. Here the common Differenceis s.

1. In any Series of Numbers in Arithmetical Progression, when the Number of Terms are even, as 1,3,5,7,9,11, or the like, the Sum of the two Extremes will be equal to the Sum of any two Means that are equally distant from the Extremes;

> Viz. 1,3,5,7,9,11. 1+11=5+7=5+9=12.

2. When the Number of Terms are odd, as 2,4,6,8,10, the Double of the middle Figure or Term will be equal to the Sum of the Extremes, or to any two Means equally distant from the middle Term;

Viz. 2,4,6,8,10. 6×2=4+1=2+10=12.

In Arithmetical Progression there are five Things to be observed, viz. 1. The first Term. O sale V sale ships so and

2. The last Term.

3. The Number of Terms.

4. The common Excess or Difference. 5. The Aggregate or Sum of all the Terms.

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Any three of which being given, the other two may be of great Cent Two Amer for an authorities

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PROPOSITION I.

When two Extremes and the Number of Terms are given, to find the Sum of all the Series or Terms.

U L E.

Multiply the Sum of the two Extremes into the Number of Terms, and divide the Product by 2. The Quotient will be the Sum of all the Series, or multiply the Sum of the two Extremes by Half the Number of Terms.

A M P L E S.

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1. How many Strokes do the Clocks at Venice (which go on to 24 o'Clock) strike in the Compass of a natural Day? Ill sord range to

2. How many Strokes do the Hammer of a Clock strike in 12 Hours ? . word and tome I the salar of any reads

3. The Length of my Garden is 94 Feet; now if Eggs be laid along the Pavement a Foot afunder, and be fetched up fingly to a Basket, removed one Foot from the first, how much Ground does he traverse that does it?

4. Suppose 100 Stones were placed in a right Line, a Yard distant from one another, and the first Stone was one Yard from a Basket; I demand how many Miles he must travel that gathers them singly into the Basket?

5. A Butcher buys 100 Sheep, and gave for the first Sheep is. and for the last of. 19s. I demand what he gave for the 100 Sheep? 12% 223/14 Newslandary 18 1 topped to 1

PROPOSITION II.

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When the two Extremes and Number of Terms are given, to find the common Difference.

The state of the second of the The Difference of the two Extremes divided by the Number of Terms less an Unity or 1, the Quotient will be the common Difference.

EXAMPLES.

6. One had 20 Children that differed alike in their Ages, the youngest was 5 Years old, the eldest 43; what was the Difference of their Ages, and the Age of each?

7. A running Footman (for a Wager) is to travel from London to a certain Place Northwards, in 19 Days, and to go but 6 Miles the first Day, increasing every Day's Journey by an equal Excess, so that the last Day's Journey may be 60 Miles: I demand each Day's Journey, and the Distance of the Place he goes to, is from London?

8. A Debt is to be discharged at 10 different Payments in Arithmetical Progression; the first Payment is to be 51. and the last 501. What is the whole Debt, and

what must each Payment be?

PROPOSITION III.

When the two Extremes and the common Difference are given, to find the Number of Terms.

RULE.

Divide the Difference of the two Extremes by the common Excess or Difference, add Unity or 1, to the Quotient, and the Sum will be the Number of Terms.

EXAMPLES.

9. A Man being asked how many Children he had, answered, my youngest Child is 5 Years old, and the eldest 43, and that he had increased one in his Family every two Years; how many Children had he?

10. A Person travelling from London Northward, went 6
Miles the first Day, and increased every Day's Journey
3 Miles, till at last he went 60 Miles in one Day: how

many Days did he travel?

PROPOSITION IV.

When the last Term, the common Difference, and the Number of Terms are given, to find the first Term.

RULE

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RULE

Multiply the Number of Terms less Unity or 1, by the common Difference, the Product subtracted from the last Term leaves the first.

EXAMPLES.

11. A Man in 19 Days went from London to a certain Place in the Country, every Day's Journey was greater than the preceding one by 3 Miles, his last Day's Journey was 60 Miles, what was the first?

12. A Person takes out of his Pocket, at 10 different Times, so many different Number of Guineas, every one exceeding the former by two, the last was 23, what was the first?

PROPOSITION V.

When the Number of Terms, common Difference, and the Sum of all the Terms are given, to find the first Term.

RULE.

Divide the Sum of all the Series by the Number of Terms, and from that Quotient fubtract Half the Product of the common Difference, multiplied by the Number of Terms less one, gives the first Term.

EXAMPLES.

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- 13. A Person is to receive 2751. at 10 different Payments, each Payment to exceed the former by 31. he is willing to bestow the first Payment on any one that can tell him what it is: What must the Arithmetician have for his Pains?
- 14. Suppose it is 100 Leagues between London and Edinburgh, two Couriers set out from each Place on the same Road; that from London towards Edinburgh travelling every Day two Leagues more than the Day before; that from Edinburgh to set off one Day after the other, travelling every Day three Leagues more than the preceding one, and that they meet exactly N 2

half Way, the first at the End of five Days, and the other at the End of four; how many Leagues did each travel per Day?

PROPOSITION VI.

When the first Term, Number of Terms, and the common Difference are given, to find the last Term.

R U L E.

Subtract the common Difference from the Product of the Number of Terms, multiplied by the common Difference, the Remainder added to the first Term will give the last.

EXAMPLES.

15. What is the last Term of an Arithmetic Progression, beginning at 6, and continuing by the Increase of 3 to 10 Places?

16. What is the last Term of an Arithmetic Progression, beginning at 1, and continuing by the Increase of 2 to

100 Places?

PROPOSITION VII.

The first Term, common Difference, and Number of Terms being given, to find the Sum of all the Series.

RULE.

From the Product of the Number of Terms in the common Difference, subtract the common Difference, and to the Remainder, add the Double of the first Term; half the Product of that Sum multiplied by the Number of Terms, gives the Sum of all the Series.

EXAMPLE.

17. A Gentleman bargains with a Bricklayer to fink him a Well 30 Yards deep, upon these Terms, viz. to pay him three Shillings for the first Yard, five for the second, seven for the third, &c. raising two Shillings for every Yard: What will be due to the Bricklayer for completing the same?

PRO-

PROPOSITION VIII.

The first Term, the Number of Terms, and Sum of all the Terms being given, to find the common Difference.

RULE.

Divide the double Sum of all the Series by the Number of Terms, and from the Quotient subtract double the first Term; divide the Remainder by the Number of Terms lessened by Unity, the Quotient will be the common Difference.

EXAMPLES.

18. A Gentleman travelled 200 Miles in eight Days, and every Day travelled equally farther than the preceding Day; it is known that the first Day he travelled fix Miles: How many Miles did he travel each of the other Days?

Miles, in 9 Days, and every Day travelled equally farther than the preceding Day; it is known that the first Day he travelled 4 Miles: How many Miles did he travel each of the other Days?

PROPOSITION IX.

When one Person or Thing moves with an equal, and another the same Way by a progressive Motion, to find what Time the first will be overtaken.

RULE.

To double the Space gone each Day by the pursued, add the common Difference of the Pursuer's Day's Journey, from that Sum subtract double the Space he travelled the first Day, and divide the Remainder by the common Difference, the Quotient will give the Number of Days, in which the Pursued will be overtaken by the Pursuer.

EXAMPLES.

20. A noted Highwayman having committed a Robbery, not suspecting a Pursuit, sled Northward at the Rate N 3

of nine Leagues a Day; one of Sir John Fielding's Men, upon the Scent, follows him in a progressive Motion, only three Leagues the first Day, five the second, seven the third, and so on, increasing every Day's Journey two Leagues: in how many Days will

the Highwayman be overtaken?

21. Y. Z. made the following Bett for 1000 Guineas, to be decided the Monday, Tuefday, and Wednefday, in Whitfun-Week, on Barham Downs, between the Hours of Eight in the Morning, and Eight at Night. Proposer has 10 choice Cricketters in full Exercise, who on this Occasion are to be distinguished by the first 10 Letters of the Alphabet. These are to run and gather up, and carry fingly 1000 Eggs, laid in a right Line, just two Yards asunder, putting them gently into a Basket placed just a Fathom behind the They are to work one at a Time, in the following Order: A. is to fetch up the first ten Eggs, B. the fecond, C. the third ten, and fo forward to K. whose turn it will be to fetch up the rooth Egg, After which A. fets out again for the next 10, B. takes the next, and fo forward alternately, till K. shall have carried up the 1000th Egg, at 100 Eggs per Man. The Fellows are to have 3001. for their three Days Work, if they do it, and it is to be distributed in Proportion to the Ground each Man shall in his Course have gone over; required, first, how many Miles each Person will have run? secondly, what Part of the gool. will come to his Share? thirdly, whether, if the Men had been posted at proper Places, they had not better have run from London to York twice, and back in the Time, taking the Measure at 180 Miles?

33. GEOMETRICAL PROGRESSION

Is when any Rank or Series of Numbers increase by one common Multiplier, or to decrease by one common Divisor. As 2.4.8.16.32.64. Here the common Multiplier or Ratio is 2.

Also 729. 243.81.27.9.3. Here the common Divisor or Ratio is 3.

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In any Series of Numbers in Geometrical Progression, the Product of the two Extremes are equal to the Product of any two Means that are equally distant from the Extremes.

As 3. 9. 27. 81. 243. 729. Here $3 \times 729 = 27 \times 81 = 9 \times 243 = 2187$.

When the Number of Terms are odd, the middle Term multiplied into itself, will be equal to the Product of the two Extremes, or any two Means equally distant from the said Mean or Middle Term.

As 3. 6. 12. 24. 48. $12 \times 12 = 6 \times 24 = 48 \times 3 = 144$.

In Geometrical Progression, the same five Things are to be observed, as in Arithmetical Progression, viz.

1. The first Term. 2. The last Term.

3. The Number of Terms.

4. The Ratio.

5. The Sum of the Terms.

Any three of these being known, the Rest may be found.

If to any Series of Numbers in Geometrical Proportion, when the first Term is not an Unit, or the same as Ratio, but not an Unit, and there be assigned a Series of Numbers in Arithmetical Progression, beginning with an Unit or 1, and whose common Difference is 1, called Indices or Exponents.

Thus \\ \ \frac{1.2.3. 4. 5. 6. 7. Indices.}{2.4.8.16.32.64.128. Number in Geometrical Progr.

The Addition or Subtraction of the Indices (or Numbers in Arithmetical Progression) directly correspond with the Product or Quotient of their respective Terms or Series in Geometrical Progression.

That is $\begin{cases} As 3 + 6 = 9. \\ So 8 \times 64 = 512 \text{ the 9th Term in ::} \end{cases}$

Again $\begin{cases} As 6+6=12. \\ So 64\times64=4092 \text{ the 12th Term in : :} \end{cases}$

Or $\begin{cases} As & 6-3=3. \\ So & 64-8=8. \end{cases}$

Or $\begin{cases} As 7-2=5. \\ So 128 \div 4=32, &c. \end{cases}$

But if the Series begin with Unity, or 1, the Indices must begin with a Cypher. Thus { 0, 1, 2, 3, 4, 5, 6, 7, &c. Indices. 1, 2, 4, 8, 16, 32, 64, 128.

Now by these Indices, and a few of the first Terms, the last Term, or any distant one, may be speedily found, without producing the whole Series.

PROPOSITION I.

When the first Term is Unity, the Ratio and Number of Terms being known, to find the last or any remote Term.

RULE.

Find a few of the leading Terms, over which place their Indices, as before directed, then find what Figures of the Indices, which added together will give the Index of the Term wanted, multiply the Numbers standing under such Indices into each other, and the last Product will be the Term required.

Note.—When the Indices begin with a Cypher, the Sum of the Indices made Choice of must be always one less than the Number of Terms given in Question, as 1 in

the Indices stands over the second Term.

EXAMPLES.

the last, reckoning a Farthing for the first, an Halfpenny for the second, &c. doubling the Price to the

last. How much did he give for them?

2. A Man bought a Horse, and by Agreement was to give what the last Nail would come to, at a Farthing for the sirst Nail, two for the second, sour for the third, &c. there were 4. Shoes, and 9 Nails in each Shoe: I demand the Price of the Horse?

PROPOSITION II

6

In any Series, not proceeding from Unity, the Ratio and first Term being given, to find any remote Term, without producing all the intermediate Terms.

RULE.

Proceed as in the last Proposition, only observe to divide every

every Product by the first Term, and the Quotient will be the Term required.

EXAMPLES.

3. A Person dying left 11 Children, to whom and to his Executor he bequeathed in the manner following, viz. To his Executor, for seeing his Will personmed, 101. the youngest Child to have 301. and so on every Child to exceed the next younger in triple Proportion: What will be the Share of the eldest?

4. A Nobleman dying left 10 Sons, to whom he left a certain Sum of Money to be divided among them, viz. the youngest Son to have 5001. the second to have as much and half as much, and so on, every one to exceed the next younger in the same Ratio of 1½. What is the Share of the eldest?

PROPOSITION III.

When the first Term, Ratio, and Number of Terms, are given, to find the Sum of all the Terms.

RULE.

Find the last Term as before, from which take the first, divide the Remainder by the Ratio, less one, and to that Quotient add the last Term, gives the Sum required.

EXAMPLES.

5. On New-Year's Day a Gentleman married, and received of his Father-in-law a Guinea, on Condition that he was to have a Present on the first Day of every Month for the first Year, which should be double still to what he had the Month before; what was the young Lady's Portion?

6. One, at a Country Fair, had a mind to a String of 20 fine Horses; but not caring to take them at 20 Guineas per Head, the Jockey consented that he should, if he thought good, pay but a single Farthing for the first, doubling it only to the 19th, and he would give the 20th into the Bargain: This being presently accepted, how were they sold per Head?

7. A

- Gentleman, well versed in Numbers, agreed with a Gentleman, to sell him 20 Yards of rich Gold brocaded Lace, for 2 Pins the first Yard, 6 for the second, 18 for the third, and so on in triple Proportion; I demand how much the Lace produced, the Pins afterwards sold at a Farthing per 100; also, whether the Laceman gained or lost by the Sale thereof, supposing the said Lace to have been bought at 81. 15. 8d. per Yard?
- 8. A cunning Servant agreed with a Master (unskilled in Numbers) to serve him 11 Years without any other Reward for his Service, but the Produce of a Wheat-Corn for the first Year, and that Product to be sown the second Year, and so on from Year to Year, until the End of the Time, allowing the Increase to be but tenfold Proportion; I demand what the 11 Years Service came to, supposing the Sum of the whole Produce to be fold at 45. per Bushel?

Note.—7680 Wheat Corns, round and dry out of the Middle

of the Ear, are computed to fill a Statute Pint.

PROPOSITION IV.

Of any decreasing Series in :, whose last Term is a Cypher, to find the Sum of those Series.

RULE.

Divide the Square of the first Term by the Difference between the said first Term, and the second Term in the Series, the Quotient will be the Sum of the Series.

EXAMPLES.

- 9. A great Ship pursues a little one, sleering the same Way, at the Distance of sour Leagues from it, and sails twice as fast as the small Ship. 'Tis asked how far the great Ship must sail before it overtakes the lesser?'
- 10. Suppose a Ball to be put in Motion by a Force which drives it 12 Miles the first Hour, 10 the second, and so on continually decreasing in Proportion of 12 to 10 to Infinity: What Space would it move through?

34. PER.

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34. PERMUTATION,

OR

VARIATIONS,

Is the changing or varying the Order of Things, in refpect of their Places.

RULE.

Multiply all the given Terms in a Series of Arithmetical Progressionals continually, whose first Term or common Difference is Unity or 1, and the last Term of the Number of Things proposed to be varied together, and the last Product will be the Number of Changes or Variations required.

EXAMPLES.

chance at a certain Inn upon the Road, where they were fo pleafed with their Landlord, and each other's Company, that in a Frolic they made a contract to stay at that Place, so long as they, together with their Landlord, could sit every Day in a different Order or Position at Dinner. Quere, the Time they staid?

2. I demand the Number of Changes that may be rung on 12 Bells; also, in what Time may they all be rung, allowing 3 Seconds to every round, and 365 Days 6 Hours to the Year?

3. An Accomptant told a Gentleman, who had constantly 8 Persons at his Table, that he would gladly make a ninth, and was willing to give 20 Guineas for his Board, so long as he could place the said Company at Dinner, differently from any one Day before; this being accepted, what did his Entertainment cost him per Year?

THE

TUTOR'S GUIDE.

PART II.

35. VULGAR FRACTIONS.

A FRACTION is a Part or Parts of fomething confidered as an Unit or Integer, and confifts in two Parts or Quantities, one wrote over the other, with a Line be-

tween them, as \(\frac{1}{4}\), \(\frac{1}{2}\), &c.

The Number placed below the Line is called the Dencminator of the Fraction, because it denominates or shews how many Parts the Unit is broken or divided into, and the Number above the Line is called the Numerator, because it enumerates or shews how many of those Parts are contained in the Fraction.

A Vulgar Fraction is either proper, improper, com-

pound, or mixed.

A proper Fraction, is when the Numerator is less than the Denominator, as $\frac{2}{3}$, $\frac{7}{8}$, $\frac{23}{36}$, $\frac{161}{215}$, &c.

An improper Fraction, is fuch whose Numerator is equal

to, or greater than its Denominator, as $\frac{2}{2}$, $\frac{18}{12}$, $\frac{247}{42}$, &c. A compound Fraction, is the Fraction of a Fraction, and

known by the Word of, as \frac{3}{7} of \frac{2}{8} of \frac{4}{5}, &c.

A mixed Number is composed of an whole Number and Fraction, as $4\frac{1}{4}$, $12\frac{7}{8}$, $142\frac{1}{16}$, &c.

36. REDUCTION of VULGAR FRACTIONS.

CASE I.

To reduce a Vulgar Fraction to its lowest Terms.

RULE.

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RULE.

Divide the greater Term by the leffer, and that Divifor by the Remainder following, till nothing remains; then by the last Remainder divide both Parts of the Fraction, and the Quotients will give the Fraction required: If the Remainder is 1, the Fraction is already in its least Terras.

EXAMPLES.

1. Reduce $\frac{335}{896}$ to its least Term.
2. Reduce $\frac{2832}{12848}$ to its lowest Terms.
3. Reduce $\frac{144}{560}$ to its lowest Terms.
4. Reduce $\frac{193}{336}$ to its lowest Terms.
5. Reduce $\frac{1476}{1938}$ to its lowest Terms.

When the Numerator and Denominator do each of them end with Cyphers, strike off an equal Number of Cyphers in both, and the remaining Figures will be a Fraction of the fame Value, which reduce to its lowest Terms.

X A M P L E S.

6. Reduce \(\frac{1}{27000}\) to its lowest Terms.

7. Reduce 4200 to its lowest Terms.

When you difcern any Number will equally divide both Numerator and Denominator, you may abbreviate the Fraction thereby.

8. Reduce $\frac{24}{112}$, $\frac{06}{324}$, $\frac{60}{144}$, and $\frac{129}{360}$ to their lowest Terms.

CASE

To reduce a compound Fraction to a fingle One.

RULE.

Multiply all the Numerators together for a new Numerator, and all Denominations for a new Denominator. Reduce the new Fraction to its lowest Terms, by the last Case.

EXAMPLES.

8. Reduce $\frac{2}{3}$ of $\frac{1}{2}$, to a fingle Fraction.

9. Reduce 4 of 7 of 70, to a Single Fraction.

10. Reduce $\frac{2}{9}$ of $\frac{3}{4}$ of 4, to a Single Fraction.

CASE III.

To Reduce whole or mixed Numbers into an improper Fraction.

UL E

1. If the whole Number has no affigned Denominator, an Unity subscribed underneath, must be the Denominator,

- 2. If the whole Number has an affigned Denominator, multiply the whole Number by the affigned Denominator, and the Product will be the Numerator to the affigned Denominator.
- 3. If the whole Number has a Fraction annexed, multiply the whole Number by the Denominator of the Fraction. and to the Product add the Numerator for a new Numerator, which place over the Denominator.

XAMPLE

12. Reduce 12, 27, and 176, to Fractions.

- 13. Reduce 27 into a Fraction, whose Denominator shall be 12.
- 14. Reduce 4²/₇ to an improper Fraction.
- 15. Reduce 161 to an improper Fraction.
- 16. Reduce 14217 to an improper Fraction.
- 17. Reduce $146\frac{21}{37}$ to an improper Fraction.

ASE

To reduce an improper Fraction, into its equivalent or proper Terms.

RUL E.

Divide the Numerator by the Denominator, the Quotient gives the whole Number, and under the Remainder (if any) fubscribe the Denominator.

EXAMPLES.

18. Reduce 30 to its proper Terms.

19. Reduce $3\frac{3}{2}$ to its proper Terms. 20. Reduce $3\frac{2}{8}\frac{8}{3}$ to its proper Terms. 21. Reduce 5423 to its proper Terms.

CASE

CASE V.

To reduce Fractions of different Denominations to Fractions of equal Value, that shall have one common Denominator.

RULE.

Multiply each Numerator (taken feparately) into all the Denominators but its own, and the Products will be the new Numerators: then multiply all the Denominators into one another for a common Denominator.

EXAMPLES.

- 22. Reduce \(\frac{3}{4}\), \(\frac{1}{12}\), and \(\frac{7}{10}\), to a common Denominator.
- 23. Reduce $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of $\frac{7}{8}$, to a common Denominator.
- 24. Reduce $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$, to a common Denominator.
- 25. Reduce $\frac{5}{6}$, $\frac{7}{10}$, $\frac{3}{4}$, and $\frac{3}{4}$ of 3, to a common Denominator.

CASE VI.

To reduce Fractions of one Denomination to another, retaining the same Value.

RULES.

1. If the Fraction given is to be brought from a less to a greater Denomination; multiply the Denominator by the Parts contained in the several Denominations between it, and that you would reduce it to, for a new Denominator, which placed under the given Numerator, will give the new Fraction, which reduce to its lowest Terms.

2. If the Fraction given is to be brought from a greater to a less Denomination, then multiply the Numerator in the same Manner as you did before the Denominator, and place over the given Denominator, and it will give the new Fraction, which also reduce to its lowest Terms.

EXAMPLES.

- 26. Reduce 3 of a Shilling to the Fraction of a Guinea.
- 27. Reduce \$\frac{1}{620}\$ of a \(\int \). to the Fraction of a Penny.
- 28. Reduce \(\frac{3}{4} \) of a Farthing to the Fraction of a Moidore.

148 Reduction of Vulgar Fractions.

29. Reduce 5 of a Penny to the Fraction of a f.

30. Reduce 1 of a Guinea to the Fraction of a Farthing.

31. Reduce 5 of a dwt. to the Fraction of alb. Troy.

32. Reduce \(\frac{3}{448}\) of a cwt. to the Fraction of a lb. Avoirdup.

33. Reduce \(\frac{3}{4}\) of a Dram to the Fraction of a cwt.

34. Reduce $\frac{5}{143}$ of a lb. Troy to the Fraction of a dwt. 35. Reduce $\frac{5}{9}$ of a League to the Fraction of a Pole.

36. Reduce $\frac{2}{45}$ of a Yard to the Fraction of a Nail.

37. Reduce $\frac{1}{12}$ of a Gallon of Wine to the Fraction of a hhd.

38. Reduce 7 of a hhd. of Ale to the Fraction of a Pint.

- 39. Reduce 7 of a Chaldron to the Fraction of a Bushel.
- 40. Reduce $\frac{3}{5}$ of a Gallon to the Fraction of a Chaldron. 41. Reduce $\frac{7}{142}$ of a Week to the Fraction of a Second.
- 42. Reduce of a Minute to the Fraction of a Day.

C A S E VII.

To find the proper Quantity or Value of a Fraction in Money, Weights, or Measures.

RULE.

Multiply the Numerator of the given Fraction, by the Parts contained in the Integer to which it belongs; then divide that Product by the Denominator, and if any Thing remains, reduce it to the next Denomination less, and divide again by the Denominator; thus proceed to the least Denomination.

EXAMPLES.

- 43. Reduce $\frac{3}{12} \frac{6}{9} \frac{7}{6}$ of a Moidore to its proper Quantity.
- 44. Reduce 15 of a Guinea to its proper Quantity.

45. Reduce 5 of a Shilling to its proper Quantity.

46. Reduce 4/5 of a Three-Pound-Twelve to its proper Quantity.

47. What is the Value of 5 of a f.?

48. Reduce 411 of a lb. Troy to its proper Quantity.

49. What is the Value of 3 of a cwt.?

50. Reduce $\frac{63}{124}$ of a Ton to its proper Quantity.

51. What is the Value of 7 of a Mile?

5.2. Reduce 5 of an Ell English to its proper Quantity.

53. Reduce 7 of an Acre to its proper Quantity.

2. Add

54. What is the Value of 11 of a hhd. of Wine?

55. Reduce 3 of a Barrel of Beer to its proper Quantity.

56. Reduce $\frac{25}{72}$ of a Chaldron of Coals to its proper Quantity.

57. What is the Value of 7 of a Month?

58. Reduce 5 of a Day to its proper Quantity.

C A S E VIII.

To reduce Money, Weights, or Measures, into Fractions.

RULE.

Reduce the given Quantity to the lowest Name mentioned for a Numerator; under which put the Number of those Parts contained in an Unit of the Integer for a Denominator, then reduce the Fraction to its lowest Terms.

EXAMPLES.

59. Reduce 6s. 81d. to the Fraction of a Pound.

60 Reduce 41d. to the Fraction of a Shilling.

61. Reduce 21. 17s. 7\frac{1}{5}d. to the Fraction of a Three-Pound-Twelve.

62. Reduce 8s. 2d. to the Fraction of a Guinea.

- 63. Reduce 60z. 17 dwts. 21 grs. to the Fraction of a lb. Troy.
- 64. Reduce 3 qrs. 3 lb. 1 oz. 125 drs. to the Fraction of a cwt.
- 65. Reduce to cwt. 18 lb. roz. 31 to the Fraction of a Ton-
- 66. Reduce 3 qrs. \(\frac{1}{8}\), to the Fraction of an Ell English.
- 67. Reduce 2 f. 6 in. into the Fraction of a Yard.
- 68. Reduce 4 fur. 32 p. to the Fraction of a Mile.

69. Reduce 3 r. 2 p. to the Fraction of an Acre.

- 70. Reduce 42 gal. of Wine to the Fraction of a hhd.
- 71. Reduce 28 gal. of Beer to the Fraction of a Barrel.
- 72. Reduce 14 bu. 2 p. to the Fraction of a Chaldron.
- 73. Reduce 1 w. 3 d. 12 h. to the Fraction of a Month.
 74. Reduce 243 d. 8 h. to the Fraction of a Year (allowing 365 Days to the Year.)

37. ADDITION of VULGAR FRACTIONS.

RULES

1. Reduce the given Fractions to a common Denominator, by Case V. in Reduction.

0 9

2. Add all the Numerators together for a new Numerator, under which subscribe the common Denominator. And if it is an improper Fraction, reduce it to its proper Terms (by Case IV.) and you have the Sum of all the Fractions.

E X A M P L E S.

1. Add $\frac{3}{7}$, $\frac{1}{4}$, and $\frac{5}{6}$, together.

2. Add $\frac{2}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$, together. 3. Add $\frac{2}{3}$ of $\frac{4}{5}$, and $\frac{13}{15}$, together. 4. Add $\frac{3}{7}$ of $\frac{5}{6}$, to $\frac{5}{9}$ of $\frac{3}{4}$.

5. Add $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ of $\frac{5}{6}$, into one Sum.

2. To add mixed Numbers.

RULE.

Reduce the Fractions to a common Denominator, and add them together, as before directed, and annex their Sum, to the Sum of the Integers.

AMPLES. E X

6. Add 4½ and 17¾ together.

7. Add $7\frac{2}{3}$, $9\frac{4}{5}$, and $6\frac{7}{10}$, together.

8. Add $8\frac{1}{2}$, $9\frac{2}{3}$, $10\frac{3}{4}$, $11\frac{4}{5}$, and $12\frac{5}{6}$, into one Sum.

3. When the given Fractions are of feveral Denominations,

UL R E.

Reduce them to one Denomination (by Cafe VIII.) then add them together as before directed; or you may reduce them to their proper Quantities (by Case IX.) and add as in Sect. 9.

X AMPLE

9. Add $\frac{201}{460}$ of a f. to $\frac{1}{8}$ of a Shilling.

10. Add 4 of a lb. Troy, to 4 of an oz.

11. Add 5 of an cwt. to 1 of a lb.

12. Add 3 of a Yard, to 2 of an Ell Eng.

13. To \(\frac{5}{6}\) of a Mile, add \(\frac{2}{3}\) of a Yard.

14. Add 3 of a Chaldron, to 2 of a Peck.

15. To 3/4 of a Week, add 5/6 of a Month. 16. Add \(\frac{3}{4}\) of an Hour, to \(\frac{5}{8}\) of a Week.

38. SUBTRACTION of VULGAR FRACTIONS.

UL E

1. Prepare the Fractions as before directed in Addition.

2. Subtract one Numerator from the other, and their Difference will be a new Numerator, under which, fubfcribe the common Denominator.

XAMPLE

- 1. It is required to fubtract 2 from 11.
- 2. From $\frac{10}{64}$ take $\frac{2}{13}$. 3. From $\frac{14}{17}$ take $\frac{7}{11}$.
- 4. From $\frac{3}{4}$ of $\frac{7}{8}$ take $\frac{2}{5}$.
- 5. From 5 of 7 take 2 of 1.
- 6. From $10\frac{3}{4}$ take $6\frac{5}{6}$.
- 7. From $17\frac{1}{12}$ take $16\frac{6}{7}$.
- 8. From 12 take 5 of 7 of 3.
- 9. From \(\frac{2}{3}\) of a Shilling take \(\frac{3}{4}\) of a Penny.
- to. From $\frac{1}{3}$ of a cwt. take $\frac{3}{4}$ of an oz.
- 11. From \(\frac{3}{4}\) of a Yard take \(\frac{3}{8}\) of an Inch.
- 12. From 3 of a Chaldron take 3 of a Peck.
- 13. From 5 of a Day take 3 of an Hour.

39. MULTIPLICATION of VULGAR FRACTIONS.

ULE

1. Prepare the Fractions to be multiplied, i. e. reduce compound Fractions to fimple ones, per Cafe II. bring mixed Numbers into improper Fractions, per Case III. then reduce the Fractions into their lowest Terms.

2. Multiply the Numerators into one another for a new Numerator; and the Denominators into one another for a new Denominator. If the Fractions will cancel, do it as in Cafe II.

X AMPLE

1. Mul. $\frac{6}{11}$ by $\frac{7}{12}$.

2. Mul. 12\frac{1}{2} by 6. 3. Mul. 173 by 7.

4. Mul. $2\frac{1}{4}$ by $\frac{3}{4}$ of $\frac{7}{8}$.

5. Mul. 123 by 7 of 12.

6. Mul. \(\frac{3}{4}\) of \(\frac{10}{11}\) by 6.

11 D

ai

th

3

4

6

7

i

7. Mul. $\frac{7}{8}$ of $\frac{3}{4}$ by $\frac{2}{5}$ of $\frac{5}{7}$ of 14. 8. Mul. $3\frac{2}{3}$ by $\frac{1}{7}$, and this Product again by $\frac{3}{5}$ of $\frac{3}{4}$.

40. DIVISION of VULGAR FRACTIONS.

U L E S.

1. Prepare the Fractions as before directed in Multiplication.

2. Multiply the Numerator of the Dividend into the Denominator of the dividing Fraction, for a new Numerator, and multiply the other Numerator and Denominator together for a new Denominator, or invert the Divisor, and then proceed as in the last Rule.

XAMPL E

1. Divide $\frac{6}{7}$ by $\frac{3}{5}$.

2. Divide $\frac{2}{11}$ by $\frac{2}{3}$ of $\frac{7}{8}$.

3. Divide $12\frac{1}{2}$ by $17\frac{2}{3}$.

4. Divide 123 by 37. 5. Divide $\frac{7}{8}$ of $\frac{3}{4}$ by $\frac{2}{5}$ of 6. Divide $7\frac{2}{7}$ by 9.

7. Divide 96 by 146.

8. Divide 143 by 3 of 12.

9. Divide $142\frac{7}{12}$ by $12\frac{3}{5}$. 10. Divide $\frac{7}{8}$ of 6 by $\frac{3}{4}$ of 5 of 11.

The RULE of THREE DIRECT. 41.

In VULGAR FRACTIONS.

There are two Methods to perform this Rule, the fecond of which is the most expeditious and easiest.

RULES.

1. Prepare the Fractions, if required, as directed in Multiplication; then proceed as in Sect. 12.—Or,

2. Having reduced the Fraction, and stated the Question,

as before directed,

3. Multiply the Denominator of your first Number into the Numerators of the fecond and third, for a new Numerator; merator; then multiply the Numerator of the first Number into the Denominator of the second and third, for a new Denominator, and place it under the new Numerator, for an Answer, which reduce to its proper Quantity; or invert the first Term, and then proceed as in Sect. 39.

EXAMPLES.

- 1. If $2\frac{2}{5}$ Yards of Silk cost $3\frac{3}{4}$. what will $4\frac{4}{5}$ Yards cost at the same Rate?
- 2. If \(\frac{3}{4}\) of a lb. cost 5s. 6d. what will 42\(\frac{3}{8}\) lb. of the same cost?
- 3. Suppose I give 14s. 8d. for \(\frac{7}{9} \) cwt. what must be given for 8 cwt. of the same, at that Rate?
- 4. A Merchant makes an Affurance upon a Ship and Cargo, bound to a certain Port, Value 27001. 10s. and agrees to pay 10 Guineas per Cent.; to what comes the Premium or Charges of the Affurance?
- 5. How much South Sea Stock, at 1125/2 per Cent. will 1270/2. Purchase?
- 6. A Mercer bought 4\frac{3}{4} Pieces of Silk, each Piece containing 22\frac{3}{3} Yards, and was to give 8s. 9d. per Yard; I demand the Value of the Whole?
- 7. If I give 100l. 10s. 6d. for 12 Pieces of Holland, at the Rate of 5s. 6\frac{3}{4}d. per Ell Flemish; I demand how many Ells English each Piece contained?

42. The RULE of THREE INVERSE.

In Vulgar Fractions.

As I observed in the Rule of Three Direct, of there being two Methods of performing it, so likewise in this.

RULES.

- 1. Prepare the Fraction as before directed, and then proceed as in Sect. 13.—Or,
- 2. Multiply the Denominator of the third Number into the Numerator of the first and second for a new Numerator; then multiply the Numerator of the third Number into the Denominator of the first and second, for a Denominator, which place under the Numerator for an Answer, and find the proper Quantity as before; or invert the last Term, and proceed as in the last Rule.

 EXAMPLES.

EXAMPLES.

1. A. lends B. $25\frac{1}{3}l$. for $6\frac{3}{4}$ Months; how long ought B. to let A. have $10\frac{3}{4}l$. to requite his Kindness?

2. If 4 Men can do a Piece of Work in 123 Hours, in how

many Hours will 12 Men do the fame?

3. If the Penny Loaf weighs 12\frac{2}{3} oz. when the Bushel of Wheat is fold for 5s. what is the Bushel worth, when the Penny Loaf weighs 8\frac{3}{4} oz.?

4. Suppose A. lends to B. $100\frac{2}{3}l$. for $6\frac{2}{3}$ Months, what Sum must B. lend A. for $3\frac{5}{6}$ Years to requite him?

5. How many Yards of Cloth at 8s. 6d. per Yard, must be given for $26\frac{5}{8}$ Yards, at 5s. 7d. per Yard?

43. The DOUBLE RULE of THREE.

In VULGAR FRACTIONS.

RULE.

Prepare the Number as before directed, and then proceed as in (17.)

EXAMPLES.

Months, at 61. per Cent. per Annum?

2. Suppose 12 Students spent 141. 6s. 8d. in 16 Days, how

much will 18 Students spend in 34 Days?

3. If the Carriage of 40 cwt. 30 Miles, cost 161. 135. 4d. What Weight may I have carried 80 Miles for 61. 175. 6d. at the same Rate?

4. Six Men with their Wives, upon Calculation, found that their Expences for three Months past (allowing 30 Days to one Month) amounted to 261. 19s. 4d. I demand what Time 141. 15s. may be spent by 36 Men in the like Proportion?

5. If 30 Men can perform a Piece of Work in eleven Days, how many will accomplish another, four Times as big,

in one fifth of the Time?

6. Agreed for the Carriage of $2\frac{1}{2}$ Tons of Goods, 3 Miles wanting $\frac{1}{10}$, for $\frac{1}{3}$ of $\frac{3}{5}$ of a Guinea: What was that per cwt. for a Mile?

OUESTIONS for EXERCISE in FRACTIONS.

as to denote and read for 100, neither more nor less:

Pray how is that to be done?

2. What Number is that, to which if $\frac{3}{10}$ of $\frac{18}{7}$ of $\frac{141}{213}$ be

added, the Total will be 1?

3. What Number is that, from which if you deduct the $\frac{1}{25}$ of $\frac{7}{8}$, and to the Remainder add $\frac{1}{16}$ of $\frac{47}{19}$, the Sum will be 3?

4. What Number is that, to which if you add $\frac{1}{11}$ of 12, more $\frac{1}{19}$ of 27, and from the Total subtract $\frac{1}{3}$ of $7\frac{1}{2}$ of

less $\frac{29}{30}$ of $1\frac{1}{4}$, the Remainder shall be 8?

5. There is a Number, which, if multiplied by \(\frac{3}{4}\) of \(\frac{7}{8}\) of \(\frac{2}{4}\), will produce no more than \(\text{1}:\) What is the Cube of that Number?

6. There is a Number, which, if divided by $\frac{12}{3}$ of $\frac{3}{16}$ will quote $9\frac{28}{37}$: Pray what is the Square of that Number?

7. If $\frac{3}{7}$ of $\frac{4}{5}$ of $\frac{7}{8}$ of a Ship be worth $\frac{1}{9}$ of $\frac{6}{7}$ of $\frac{11}{13}$ of the Cargo, Value at 12001. what did both Ship and Cargo stand the Owners in?

8. A Person was possessed of a 3 Share of a Copper Mine, and fold 3 of his Interest therein for 17101. what was the reputed Value of the whole Property at the same Rate?

9. A Father devised \(^3\frac{4}{8}\) of his Estate to one of his Sons, and \(^3\frac{4}{8}\) of the Residue to another, and the Surplus to his Relict, for her Life; the Children's Legacies were found to be \(^257\)l. \(^3\)s. \(^4\)d. different: Pray what Money did he leave the Widow the Use of?

10. A Person making his Will, gave to one Child $\frac{19}{30}$ of his Estate, to another $\frac{11}{39}$, and when these Legacies came to be paid, one turned out 5401. 105. more than the

other: What did the Testator die worth?

11. A Lad having got 4000 Nuts, in his return home was met by Mad Tom, who took from him $\frac{5}{8}$ of $\frac{2}{3}$ of his whole Stock. Raving Ned lights on him afterwards, and forced $\frac{2}{5}$ of $\frac{5}{8}$ of the Remainder from him; unluckily, Positive Jack found him, and required $\frac{7}{10}$ of $\frac{17}{20}$ of what he had left. Smiling Dolly was, by promise, to have $\frac{3}{4}$ of a Quarter of what Nuts he brought home; how many then had the Boy left?

12. A

12. A younger Brother received 22001. which was just 12 of his elder Brother's Fortune; and 3 and 1 Times the Elder's Money was 2 as much again as the Father was

2

worth; what was that?

13. In Diffress at Sea, they threw out 17 hhds. of Sugar, worth 341. per hhd. the Worth of which came up to but 4 of the Indigo they cast overboard; besides which they threw out 13 Iron Guns worth 181. 10s. a Piece; the Value of all amounted to $\frac{3}{7}$ of $\frac{9}{13}$ of that and the Ship and Loading: Pray what of the Value came into the Port?

14. If A. having 3 of 3 of the Half of a trading Sloop and Cargo, worth 161311. 7 fells his Brother B. 3 of 4 of his Interest therein at prime Cost; what did it cost the Brother, and what did his Cousin P. pay at the same

Time for $\frac{9}{11}$ of the Remainder?

15. X. Y. and Z. can, working together, complete a Stair-Case in 12 Days; Z. is Man enough to do it alone in 24 Days, and X. in 34; in what Time then could Y.

get it done himfelf?

16. A Father dying left his Son a Fortune, 3 of which he ran through in fix Months; 2 of the Remainder held him a Twelvemonth longer, at which Time he had bare 3481. left: Pray what did his Father bequeath him?

17. Kitty told her Brother George, that though her Fortune on her Marriage took 193121. out of the Family, it was but \(\frac{3}{5} \) of 2 Years Rent. Heaven be praised for

this Yearly Income! Pray what was it?

18. A merry young Fellow in a short Time got the better of \(\frac{1}{2}\) of his Fortune; by Advice of his Friends he then gave 22001. for an Exempt's Place in the Guards; his Profusion continued till he had no more than 880 Guineas left, which he found by computation was just $\frac{3}{20}$ Part of his Money, after the Commission was bought:

Pray what was his Fortune at first?

19. A Person dying, left his Wife with Child, and making his Will, ordered, that if the went with a Son, $\frac{2}{3}$ of the Estate should belong to him, and the Remainder to his Mother; and if she went with a Daughter, he appointed the Mother $\frac{2}{5}$, and the Girl $\frac{1}{3}$: But it happened that fhe was delivered both of a Son and Daughter; by which she lost in Equity 2000l. more than if it had been only a Girl: What would have been her Dowry had

fhe only had a Son?

20. A Ciftern holds 103 Gallons, and being brim-full, has two Cocks to run off the Water: by the first of which, a three Gallon Pail will be filled in 60 Seconds, by the other in 75; in what Time will this Ciftern be emptied through both these Apertures together, supposing the Efflux of the Water all the same?

21. A Politician having about him a certain Number of Crowns, faid, If $\frac{1}{4} + \frac{1}{3} + \frac{1}{6}$ of what he had, were added together, they would make just Wilkes's Number (4.5);

how many Crowns had he about him?

22. A Gentleman has an Orchard of Fruit Trees, one half of the Trees bearing Apples, one fourth Pears, one fixth Plumbs, and one twelfth of them bearing Cherries: How many Fruit Trees in all grow in the faid Orchard?

23. A School Master being asked how many Scholars he had, answered, If I had as many, and ½ as many, and ¼ as many, I should have 99. How many had he?

24. In the Year I wrote this, if to my Age you add

 $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{5}$, (thereof), with $\frac{4}{5}$ more, The Number 74 will then be had.

Ingenious Youths, my Age explore.

25. A. in a Scuffle, seized on \(\frac{2}{3}\) of a Parcel of Sugar-Plums, B. catched 3 of it out of his Hands, and C. laid hold on $\frac{3}{10}$ more; D. ran off with all A. had left, except $\frac{1}{2}$, which E. afterwards fecured flily for himself; then A. and C. jointly fet upon B. who, in the Conflict, shed to he had, which were equally picked up by D. and E. who lay perdue. B. then kicked down C.'s Hat, and to work they all went anew for what it contained; of which A. got $\frac{1}{4}$, B. $\frac{1}{2}$, D. $\frac{2}{7}$, and C. and E. equal Shares of what was left of that Stock; D. then struck 3 of what A. and B. last acquired out of their Hands; they with Difficulty recovered 5 of it in equal Shares again, but the other three carried off \(\frac{1}{5}\) a piece of the fame. Upon this they called a Truce, and agreed, that the $\frac{1}{3}$ of the Whole left by A. at first should be equally divided among them: How much of the Prize, after this Distribution, remained with each of the Competitors?



THE

TUTOR'S GUIDE.

PART III.

44. DECIMAL FRACTIONS.

A Decimal Fraction, is a Fraction whose Denominator is always Unity or 1, with one or more Cyphers: Thus, an Unit may be imagined to be equally divided into 10 Parts, and each of these into 10 more; so that by a continual Decimal Sub-division, the Unit may be supposed to be divided into 10, 100, 1000, and so on without End, all being equal Parts, called tenth, hundredth, thousandth Part of an Unit or 1.

In Decimal Fractions, the Figures of the Numerator are only expressed, the Denominator being omitted, because it is always known to consist of an Unit with so many Cyphers as there are Places in the Numerator.

A Decimal Fraction is diftinguished from an Integer with a Point or Comma prefixed, thus, ,5 wich stands for $\frac{5}{10}$, or $\frac{1}{2}$; ,75 for $\frac{75}{100}$, or $\frac{3}{4}$; ,2752 for $\frac{2752}{10000}$; and 12,005 for $12,\frac{5}{10}$, &c.

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Cyphers at the Right Hand of a Decimal Fraction alter not its Value: for ,5 or ,50 or ,5000 is each of them the fame Value, and are equal to $\frac{5}{10}$ or $\frac{1}{3}$; but Cyphers at the Left Hand, in a Decimal Fraction, decrease the Value in a tenfold Proportion, for ,05 is $\frac{5}{100}$, also, 0005 is $\frac{5}{10000}$, &c. all of which will plainly appear by the following TABLE.

T A B L 2 Parts
A Parts
J Units
T 3 Hund

4 Thousands.
5 Tens of Thousands
6 C. of Thousands.
7 Millions.

Parts of a Million.
6 Parts of one C. Thousand.
5 Parts of ten Thousand.
4 Parts of one Thousand.
6 Parts of one Hundred.
8 Parts of Ten.

By the above Table it also plainly appears, that as whole Numbers increase towards the Left Hand by a ten-fold Proportion, so Decimal Parts decrease towards the Right Hand by the same Proportion.

A finite Decimal is that which ends at a certain Number of Places; but an infinite is that which no where ends.

A circulating or recurring Decimal, is that wherein one or more Figures are continually repeated.

Thus 64,766666, &c. or 64,76, is called a fingle circulate or recurring Decimal.

And 147,642642, &c. or 147,842, is called a compound

recurring Decimal.

Note.—In all Operations, if the Refult confilts of feveral Nines, reject them, and make the next superior Place 2 Unity more. Thus, for 17,1999 write 17,2; and for 12,99 write 13, &c.

45. ADDITION of DECIMALS.

1. Addition and Subtraction in Decimals, are performed after the same Manner as Sect. 2, 3, of whole Numbers, Care being taken that like Parts be placed under one another, and from their Sum or Difference cut off so many Decimal Parts as there are the most in any of the given Numbers.

EXAMPLES.

1. What is the Sum of ,0476, 21,476, ,0067, 64, 17,6, and ,20764?

P 2

2. Add

2. Add ,427, 64,075, 27,6421, 10,8, ,0074, and 104, ,046842, together.

3. What is the Sum of ,274, ,076, ,64762, ,0706, ,47, ,007, and 968,42?

2d. To add Decimals, wherein there are fingle Repetends.

RULE.

Make every Line end at the same Place, filling up the Vacancies by the repeating Digits, and annexing a Cypher or Cyphers to the finite Terms; then add as before; only increase the Sum of the Right Hand Row, with as many Units as it contains Nines, and the Figure in the Sum under that Place will be a Repetend.

EXAMPLES.

- 4. What is the Sum of 47,674, 4,02642, 32,6, 6,14, and 27,0646?
- 5. Add 11,4, 6,14274, 91,78, 37,67x, and 146,476742.
 6. What is the Sum of 14,276421, 7,4, 21,646, 9,27, and 31,1474?

3d. To add Decimals, having compound Repetends.

RULE.

Make the Repetends similar and conterminous; then addas before, only increase the Right Hand Figure by as many Units as are carried from the Column of Figures, wherein all the Repetends begin together; lastly, dash off for a Repetend as many places as were so in the Numbers, added together.

EXAMPLES.

- 7. What is the Sum of 14,2472, 768,248, 7,064, and 26,0062?
- 8. Add, 246, 3,67, 27,0427694, and 9,943, together.

46. SUBTRACTION of DECIMALS.

EXAMPLES.

1. What is the Difference between 176, and 10,764?
2. From

2. From 647, take ,00746.

3. What is the Difference between 74,6407, and 69,5?

2d. To fubtract Decimals that have a fingle Repetend.

RULE.

Make both end together as in Addition; and if the Repetend of the Number to be subtracted, be greater than the Repetend of the Number it is to be taken from, then the Right Hand Figure of the Remainder must be less by Unity than it would be; or instead of borrowing Ten, as in whole Numbers or Infinites, borrow in this Place 9, the rest as usual, and the Right Hand Place or Figure will be a Repetend.

EXAMPLES.

4. What is the Difference between 41,74, and 21,94648?

5. From 24, 1466, take 19,9.

6. What is the Difference between 16,126, and 4,1942764?

47. MULTIPLICATION of DECIMALS.

1st. Multiplication in Decimals is also performed as in whole Numbers, no Regard being had to the Decimals as such, till the Product is obtained, then observe the following

RULES.

1. Strike off fo many Figures from the Right Hand of the Product as there are Decimal Places in the Multiplier and Multiplicand.

2. But if there are not so many Figures in the Product, supply the Desiciency by prefixing Cyphers to the Lest

Hand to make them equal.

3. If the Number is to be multiplied by 10,1000, &c. remove the separating Point in the Multiplicand so many Places towards the Right Hand, as there are Cyphers in the Multiplier.

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- 1. Multiply ,17,504, by 76. 2. Mul. 27,42, by 3,56.
- 3. Mul. 8,04704, by ,2575. 4. Mul. 5745, by ,0675.
- 5. Mul., 4 by, 2. 6. Mul., 047 by, 046.
- 7. Mul.,0476 by ,02078. 8. Mul.,47 by ,0008.
- 9. Mul., 1076 by 1000. 10. Mul., 42768 by 10000.

2d. When the Product will contain more Decimals than are necessary for the present Purpose, the Work may be contracted by the following

RULE.

Write down the Multiplicand as usual, then write under it the Multiplier inverted, with the Unit Place thereof under that Place of the Multiplicand, whose Place you intend the Product shall extend to; then multiply as usual, by each Figure of the Multiplier, beginning with those of the Multiplicand which stand over it, neglecting those to the Right Hand, unless so far as to observe what would arise from multiplying the Figures immediately foregoing, which must be taken in at the Beginning of each Line, the first Figure of each particular Product must stand underneath one another.

Note.—In multiplying the Figure lest out every Time, next the Right Hand in the Multiplicand, if the Product be 5, or upwards to 15, carry 1; if 15, or upwards to 25, carry 2; and if 25, or upwards to 35, carry 3, &c.

EXAMPLES.

- and to have only three Places of Decimals in the Product.
- 12. Multiply 47,689464 by 26,17694, retaining five Decimals in the Product.
- 3d. If the Right Hand Figure of the Multiplicand be a Circulate.

RULE.

Multiply the Multiplicand before, by every Figure in the Multiplier; observing to increase the Right Hand of each each refulting Line, by as many Units as there are Nines in the Product of the first Figure in that Line, and the right Hand Figure of each Line will be a Circulate; and before you add them together, make them all end at the same Place as shewn in Addition,

EXAMPLES.

13. Let it be required to multiply 147,64 by ,7.

14. Multiply 42,642 by ,276.

4th. When the right Hand Figure of the Multiplier be a Circulate.

RULE.

Multiply by, as by a finite Digit, fetting the Product one Place extraordinary towards the left Hand; then divide the Product by 9, continuing the Quotient if needful, till it arrives at a Circulate; then beginning at the Place under the right Hand Figure of the Multiplicand, cut off for Decimal Parts.

EXAMPLES.

15. Multiply 46,2762 by ,8.

16. Let it be required to multiply 261,276 by ,47.

5th. When the Multiplicand and Multiplier are each a fingle Circulate.

RULE.

The first Line (or that produced by multiplying the Circulate in the Multiplier) must be managed as in Note 2, only the right Hand Figure must be increased by as many Units as there are Nines in the Product of the First Figure of that Line; the Product of the Rest must be managed as directed in Note 1.

EXAMPLES.

17. Multiply 141,14 by 8,47.

18. Let it be required to multiply 24,6072 by ,496.

6th. If the Multiplicand be a compound Repetend, and the Multiplier a finite Number.

RULE.

RULE.

In multiplying, observe to add to the right Hand Place of the Product, so many Units as there are Tens in the Product of the lest Hand Place of the Repetend; and the Product shall contain a Repetend, whose Places are equal to those in the Multiplicand, and if there be more Places of Figures in the Multiplier than one, make all the several Products conterminous towards the right Hand, (3. and 6th.)

EXAMPLES.

19. Multiply 7,642 by 6. 20. Multiply 64,842 by 27,9.
7th. If the Multiplier be a compound Repetend.

RULE.

Multiply each Figure of the Repetend, and add the feveral Products together, then add the Refult in this Manner; fet the left Hand Figure fo many Places forward, as exceeds the Number of Places in the Repetend by one, and the Rest of the Figures in Order after it; and thus proceed, till the Result last added is beyond the first; lastly, add the several Results together, beginning under the right Hand Place of the first, and from thence dash as many Figures for a Repetend, as the Repetend of the Multiplier consists of.

EXAMPLES.

21. Mul. 46,74 by 4,207. 22. Mul. 764,742 by 6074.

8th. If both Factors have compound Repetends.

RULE.

Proceed as in the two last Cases; for as the Places of the Repetend in the Product will be uncertain as to their Number, they can only be determined (in any Manner sit for Practice) by continuing and repeating the first Product, which will contain a certain Repetend, equal to that of the Multiplicand.

EXAMPLES.

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X A M P L E S.

23. Mul. 47,642 by 3,674. 24. Mul. 7,628 by 8,495.

48. DIVISION of DECIMALS.

In Division of Decimals, the Work is likewise performed as in Whole Numbers; the only Difficulty is in valuing the Quotient, which will be very eafy by observing either of the following general

R U L E

1. The first Figure in the Quotient is always of the same Value with that Figure of the Dividend, which answers or stands over the Place of Units in the Divisor.

2. The Quotient must always have so many Decimal Places, as the Dividend has more than the Divisor.

X A M

- 1. Divide 1735,5 by 6,5.
- 3. Divide 186,9 by 7,476.
- 5. Div. 246, 1476 by 604, 25.
- 7. Divide 6,7258 by 647.
- 9. Divide 487,67 by 1000.
- 2. Divide, 8332 by,0084.
- 4. Divide 6 by ,008.
- 6. Divide 7,268401 by 119.
- 8. Divide ,0008136 by 678.
- 10. Divide 4746 by 10000.
- 2d. There is also a compendious Way of contracting the Work, reverse to that in Page 162, by which much Labour is faved, especially when the Divisor hath many Places of Decimal Parts in it; and is performed by the following

Ù R L

By the first Rule find what is the Value of the first Figure in the Quotient; then, by knowing the Denomination of the first Figure, the Decimal Places may be reduced to any Number proposed, by taking as many of the left Hand Figures of the Dividend as will answer them, and in dividing, omit, or prick off one Figure of the Divisor at each Operation, that is, for every Figure you place in the Quotient, prick off one in the Divisor; having a due Regard to the Increase which would arise from the Figure so omitted. (See Note in Page 166.) EXAMPLES.

- 11. Divide 913,08 by 2137,2, and let the Quotient only contain three Decimal Places.
- 12. Divide 6109,2674 by 240,649, and let there be only four Places of Decimals in the Quotient.
- 3d. When the Dividend is a fingle or compound Repetend.

R U L E.

If it be a fingle Repetend, bring down the circulating Figure, until the Quotient either repeats, or is as exact as required; but if the Repetend in the Dividend be a compound one, then bring down the circulating Figures in the same Order they stand in; and when you have got through them all, bring down the first Figure in the Repetend over again, and so proceed until your Quotient either repeats, or be as exact as necessary.

EXAMPLES.

13. Divide 14,4 by 6,84.

14. Let it be required to divide 1694,647 by 46,849.

4th. If the Divisor be a single Repetend.

RULE.

Place the Dividend under itself, but removed one Place towards the right Hand, which subtract, and the Remainder will be a new Dividend; which Divide by the Divisor in the same Manner, as if it was a terminate Number.

EXAMPLES.

15. Divide 42,86 by 8. 16. Divide 6,426 by 6,8.

5th. If the Divisor and Dividend consist of terminate Numbers joined to the Repetend.

RULE.

R U L E.

Place the Divisor and Dividend under each other, but removed one Place towards the right Hand; then subtract the Lower Lines: From the Upper, the Remainder will be a new Divisor and Dividend, which proceed with as before directed.

EXAMPLES.

17. Divide 81869,8694 by 7414,864.
18. Divide 9,46946 by 64,842.

6th. If a compound Repetend is found in your Divisor, or in both your Divisor and Dividend.

R U L E.

Proceed as in the last Case with your Divisor and Dividend, only remove them each so many Places towards the right Hand, as they have Places in the Repetend of the Divisor; but if the Divisor is a compound Repetend without any terminate Figures, divide by it as a terminate Number; first subtracting the Dividend from itself, as above directed.

EXAMPLES.

19. Divide 147,42683 by 8,467. 20. Divide 4176,4268268 by 37,26974.

49. REDUCTION of DECIMALS.

1. To reduce a Vulgar Fraction to a Decimal.

Add Cyphers to the Numerator, and divide by the Denominator, the Quotient will be the Decimal Fraction required.

EXAMPLES.

- 1. Reduce \(\frac{1}{4}\), \(\frac{1}{2}\), and \(\frac{3}{4}\), to Decimals.
- 2. Reduce 24 to a Decimal.
- 3. Reduce 3 of 3 to a Decimal.
- 4. Reduce 4 to a Decimal.
- 5. Reduce \(\frac{2}{3}\) to a Decimal.
- 6. Reduce \(\frac{3}{4}\) of \(\frac{7}{2}\) of \(\frac{7}{8}\) to a Decimal.
- 7. Reduce \(\frac{1}{4}\) of \(\frac{1}{12}\) to a Decimal.
- 2. To reduce Coins, Weights, Measures, &c. into Decimals.

RULE I.

Reduce the given Money, Weights, &c. into the lowest Denomination or Name mentioned, for a Dividend; then reduce the integer into the same Denomination for a Divisor, the Result will be the Decimal required.

RULE II.

Write the given Denomination or Parts orderly under each other, the inferior or least Parts being uppermost; let these be the Dividends. Against each Part on the Lest Hand, write the Number thereof contained in one of its superior; let these be Divisors. Then beginning with the lowest Denomination with Cyphers added (making a Dot between the Cyphers and the Figure) and divide, writing the Quotient of each Divisor as Decimal Parts on the Right Hand of the Dividend next below it; and let this mixt Number be divided by its Divisor, and so on, till all be finished, and the last Quotient will be the Decimal required.

RULE III.

To reduce Shillings, Pence, and Farthings; if the Number of Shillings be even, take Half for the first Place of Decimals, and let the second and third Place be filled up with the Farthings contained in the remaining Pence and and Farthing, always remembering to add 1, when they are 25; if 40 add 2: But if the Number of Shillings be odd, multiply them by 5, and proceed with the Pence and Farthings as before.

EXAMPLES.

- 1. Reduce 17s. 63d. to the Decimal of a Pound.
- 2. Reduce 6s. gd. to the Decimal of a &.
- 3. Reduce 9s. to the Decimal of a Guinea.
- 4. Reduce 14s. 6 d. to the Decimal of a Moidore.
- 5. Reduce 18s. 41d. to the Decimal of a f.
- 6. Reduce t of a Penny to the Decimal of a f.
- 7. Reduce 11 dwts. to the Decimal of a fb. Troy.
- 8. Reduce to Drams to the Decimal of a lb. Avoirdupoife,
- 9. Reduce 3 grs. 14 lb. to the Decimal of a cwt.
- to. Reduce 6 Inches to the Decimal of a Yard.
- 11. Reduce 6 Furlongs to the Decimal of a League.
- 12. Reduce 18 gall. 2 qts. of Wine to the Decimal of a Tun.
- rg. Reduce 3 qrs. 1 pt. of Ale to the Decimal of a Barrel.
- 14. Reduce 8 Perches to the Decimal of an Acre.
- 15. Reduce 4 Bushels 2 Pecks to the Decimal of a Chaldron.
- 16. Reduce 12 Minutes to the Decimal of an Hour.
- 17. Reduce 12 Days to the Decimal of a Year (Julian).

By this Rule, the following Decimal Tables are made.

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				47 W. A.		
1 Decin	nai Tables	of Con	N, WEIGHT	, and M	EASURE.	
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13,6			z. will also	9 8	,080357	
12,6		Merve	for Inches,	8	,071428	
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101,5		Penny	Decimals.	Tel. 1	,053571	
Pence.	Decimals.	weight.	241666	5	,044643	
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9	,0375	A STATE OF THE STA	,033333	2	,017857	
8	,033333	7 6	,025	1	,008928	
7 6	,029166	5	,020833	Ounces	Decimals.	
6	,025	4	,016666	10	,00558	
5	,020833	3	,0125	9 8	,005022	
1 4	,016666	2	,008333		,004464	
3 2	,0125	I	,004166	7 6	,003906	
	,008333	Grains	Decimals.	5	,003348	
1	,00416	20	,003472	4	,002/9	
Farth.	Decimals.	10	,001736	3	,001673	
14 - 1 - 1 - 1 - 1 - 1	,003125		,001562	3 2	,001116	
3 2	,002083	8	,001389	ı	,000558	
1	,001042		,001215	Drams	Decimals.	
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	TROY WEIGHT.		,000694	8	,000279	
I Ilb. t	1 lb. the Integer.		,000521	7	,000244	
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11.	,916666	1	,000173	9 8 7 6 5 4	,000174	
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Decim	Decimal TABLES of COIN, WEIGHT, and MEASURE.						
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3	,000069	8	,035714	1	1		su,h.
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Avoir.	WEIGHT.	4	,015873	2. p.	1. 1. 12		reck.
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6	,023427	20	,31746				SURE.
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		5	,079365	17	00		7727
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	e Integer.		,031746	40	00		7272
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,004545	2	,005479	2	,125
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	I Day th	e Integer.		
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	2	,083333		,25641
		.041666		,205128
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,164283	7	.002///	11	,0050366
136486	0		10	,0945787
100,589			9	,0041208
,082192	200		Market Co., Control of	,003663
.054794			7	,0032051
.027397			6	,0027472
,024657	I Yard t	he Integer.		L0022802
,021018				,0018318
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	,003977 ,003409 ,002841 ,002273 ,001704 ,001139 ,000568 Decimals. ,0003787 ,0001894 Decimals. ,000947 ,0000474 ,0000158 LE VIII.	,003977 ,003409 ,002841	1 002739 1 002777 1 1 1 1 1 1 1 1 1	1 1,002739 1 1,002739 1 1,003409 1 1,002739 1 1,002739 1 1,003409 1 1,002739 1 1,002739 1 1,002739 1 1,002739 1 1,002739 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002273 1 1,002277 1 1,0022739 1 1,002277 1

CASE III.

To find the Value of any Decimal Fraction, in Money, Weight, Meafure, &c.

RULE.

Multiply the Decimal by the Number of Parts of the next inferior Denomination, cutting off fo many Places for Decimals to the Right Hand, as your given Decimal confifts of, and those on the Left will be Integers; then multiply the remaining Decimals by the next inferior Denomination, and cut off for Decimals as before; thus proceed till you have brought it into the least Parts of the Integer.

EXAMPLES.

- 1. What is the Value of ,878125 of a Pound Sterling?
- 2. What is the Value of ,3375 of a £.?
- 3. What is the Value of ,45 of a Guinea?
- 4. What is the Value of ,72708 of a Moidore?
- 5. What is the Value of ,00243 of a lb. Troy?
- 6. What is the Value of ,3375 of a Ton?
- 7. What is the Value of ,0396 of a lb. Avoirdupoise?
- 8. What is the Value of ,875 of a cwt.?
- 9. What is the Value of , 16669 of a Yard?
- 10. What is the Value of ,259 of a League?
- 11. What is the Value of , 29365 of a hhd. of Wine?
- 12. What is the Value of ,875 of a Barrel of Ale?
- 13. What is the Value of ,05 of an Acre?
- 14. What is the Value of ,125 of a Chaldron of Coals?
- 15. What is the Value of ,4765 of a Day?

50. EXTRACTION of the SQUARE ROOT.

Extracting the Square Root, is to find out fuch a Number as being multiplied into itself, the Product will be equal to the given Number.

As the Square Root of 81 is 9, consequently $9 \times 9 = 81$ the given Number.

Roots.	1	2	3	4	5	6	7	1819
Squares.	I.	4	9	16	25	36.	49	64 81

To extract the Square Root of any Number, observe the following

RULES

1. Point the given Number or Resolvend into Periods of

two Figures each, beginning at the Units Place.

2. Find by the Table the greatest Square Number that is contained in the first Period towards the Lest-hand, placing the Square Number under the first Period, and the Root thereof in the Quotient (as in Division), subtract that Square out of the said Period, and to the Remainder bring down the next Period for a Dividend.

3. Double the Quotient or Root, and place it for a Divifor, feek how often the Divifor is contained in the Dividend (referving always the Unit's Place), and put the Answer in the Quotient, and also on the Right Hand of the Divisor: Then Multiply the Divisor by the last Figure put in the Quotient (as in common Division), the Product subtract from the Dividend, and to the Remainder bring down the next Period, which proceed with as before.

Note 1. But if it happens that the given Refolvend is not a perfect Square, Cube, &c. then fomething will remain after Extraction hath been made throughout all the Points: When this is the Cafe, you must amex Cyphers according as the proposed Power requires, viz. by Pairs or Two's in the Square; Three's in the Cube, &c. and the Operation continued as before.

2. If the given Resolvend consists of a whole Number and Decimals together, make the Number of Decimals

even by adding Cyphers to them.

EXAMPLES.

- r. Let it be required to extract the Square Root of 74770609.
- 2. What is the Square Root of 60516?
 3. What is the Square Root of 7658?

4. What is the Square Root of 39348647

- 5. What is the Square Root of 8209667940,5297
- 6. What is the Square Root of ,000729?

7. What is the Square Root of 2?

8. What is the Square Root of 2,2710957?
9. What is the Square Root of 36,00000625?

To extract the Square Root of VULGAR FRACTIONS.

RULE.

Reduce the Fraction or Fractional Parts to its lowest Terms, and if it be a mixed Number, to an improper Fraction; then extract the Square Root of the Numerator for a new Numerator, and the Square Root of the Denominator for a new Denominator.

EXAMPLES.

- 1. What is the Square Root of 25?
- 2. What is the Square Root of \$\frac{22.5}{32.4}?
- 3. What is the Square Root of 1039?
- 4. What is the Square Root of 27 16 ?

SURDS.

To extract the Square Roots of Vulgar Fractions, when they be Surds, i. e. a Number where a Root can never be exactly found.

RULE.

Reduce the Fraction or Fractional Part to its lowest Terms, then reduce it to a Decimal, and annex that Decimal to the Whole Number (if any) and extract the Square Root therefrom.

EXAMPLES.

- 5. What is the Square Root of 83?
- 6. What is the Square Root of 597?
- 7. What is the Square Root of 7614?

51. The USE of the SQUARE ROOT.

CASE I.

To find a mean Proportion between any two given Numbers.

R U L-E.

Multiply the two given Numbers together, and extract the Square Root of the Product, which Roots will be a mean Proportional fought.

E XAMPLE

1. What is the mean Proportional between 4 and 9?

2. What is the mean Proportional between 16 and 36?

CASE II.

To find the Side of a Square equal in Area to any given Superficies.

RULE.

Extract the Square Root of the given Superficies, which Root will be the Side of the Square fought.

X A M P L E S.

3. If the Area of a given Circle is 4276,5, I demand the Side of a Square, whose superficial Content shall be equal thereto?

4. Suppose I have an elliptical or irregular Fish-Pond, containing in Surface 9 Acres, 2 Roods, 15 Perches, and would have a fquare one of the fame Content; I defire you'd tell how many Yards each Side must be?

5. If the Content of a given Circle be 160, what is the Side of a Square equal thereto?

ASE III.

Having the Area of a Circle, to find the Diameter.

RULE.

As 355: 452: : or, as 1: 1,273239: : fo is the Area to the Square of the Diameter: or multiply the Square Root of the Area by 1,12837, and the Product will be the Answer. (See Problem VI. in Mensuration.)

EXAMPLES.

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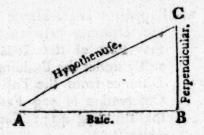
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8.

- 6. Required the Diameter of a Circle that will comprehend within its Circumference, the Quantity of an Acre of Land.
- 7. In the Midst of a Meadow well stored with Grafs,
 I took just two Acres to tether my Horse;
 How long must the Cord be, that feeding all round,
 He mayn't graze less or more than these two Acres of
 Ground?

CASE IV.

Any two Sides of a right-angled Triangle, ABC, being given, to find the remaining Side.



1. The Base and Perpendicular being given to find the Hypotheruse.

RULE.

Square each Side, add the Squares together, and the Square Root of this Sum gives the Hypothenuse required.

2. If the Hypothenuse and one Side be given, to find the other Side.

RULE.

From the Square of the Hypothenuse, subtract the Square of the given Side, the Square Root of the Remainder gives the Side required.

EXAMPLES.

8. At Matlock, near the Peak in Derbyshire, where are many surprising Curiosities in Nature, is a Rock by the Side of the River Derwent, rising perpendicular

to a wenderful Height, which being inaccessible, I endeavoured to measure, and found by a mathematical Method, that the Distance between the Place of Observation and the Foot of the Rock to be 55½ Yards, and from the Top of the Rock to the said Place to be 140½ Yards (nearly), required the Height of this stupendous Work?

9. A Ladder 40 Feet long may be fo planted, that it shall reach a Window 33 Feet from the Ground on one Side the Street; and, without moving it at the Foot, will do the same by a Window 21 Feet high on the other

Side; the Breadth of the Street is required?

of a Fort, on the opposite Bank of a River, known to be 23 Yards broad: The Height of the Wall is

required?

11. Suppose a Light-House built on the Top of a Rock, the Distance between the Place of Observation and that Part of the Rock level with the Eye, and directly under the Building, is given 310 Fathoms; the Distance from the Top of the Rock to the Place of Observation is 423 Fathoms; and from the Top of the Building 425: The Height of the Edifice is required?

12. Two Ships fet fail from the fame Port, one of them fails due East 50 Leagues, the other due North 84:

How far are they afunder?

QUESTIONS for Exercise at leisure Hours.

13. The Height of an Elm, growing in the Middle of a circular Island 30 Feet in Diameter, plumbs 53 Feet, and a Line, stretched from the Top of the Tree straight to the hither Edge of the Water, 112 Feet: What then is the Breadth of the Moat, supposing the Land on the other Side the Water to be level?

14. Require the Length of a Shoar, that being to first II

Feet from the Upright of a Building, will support a

Jamb 23 Feet 10 Inches from the Ground?

15. There are two Columns, in the Ruins of Persepolis. left standing upright, one is 64 Feet above the Plane, the other 50: Between these, in a right Line, stands

an ancient Statue, the head whereof is 97 Feet from the Summit of the higher, and 86 Feet from the Top of the lower Column; the Base whereof measures just 76 Feet to the Center of the Figure's Base: By these Notices, the Distance of the Top of the Colomn may be, by Numbers, easily found.

To be an Hundred Feet from th' Top to th' Ground;
Against the Wall a Ladder stood upright,
Of the same Length the Castle was in Height.
A waggish Youth did the Ladder Slide,
(The Bottom of it) ten Feet from the Side:
Now I would know how far the top did fall,
By pulling out the Ladder from the Wall?

As I was walking out one Day, Which happened on the first of May, As Luck would have it, I did fpy A May-Pole raifed up on high, The which at first me much furpris'd. Not being before-hand advertis'd Of fuch a ftrange uncommon fight; I faid I would not fir that Night. Nor rest content until I'd found Its Height exact from off the Ground; But when these Words I just had spoke, A Blast of Wind the May-Pole broke, Whose broken Piece I found to be Exact in Length Yards fixty-three, Which by its Fall broke up a Hole, Twice fifteen Yards from off the Pole; But this being all that I can do, The May-Pole now being broke in two Unequal Parts, to aid a Friend, Ye Youths, pray then an Answer send.

CASE V.

Any Number of Men being given, to form them into fquare Battle, or to find the Number of Ranks and Files.

RULE.

Extract the Square Root of the Number of Men given, will give the Number of Men either in Rank or File.

EXAMPLE.

is. A General disposing his Army into a square Battle, finds he has 23716 Men; required the Number in Rank and File.

52. The EXTRACTION of the CUBE ROOT.

To extract the Cube Root, is to find out a Number, which being multiplied into itself, and then again into the Product, produceth the given Number.

As the Cube Root of 729 is 9, consequently $9 \times 9 \times 9 = 729$ the given Number, and to of others, as in the following Table.

Roots.	1	2	3	4	5	6	7	8	9
Cube.	1	8	27	64	125	216	343	512	729

RULES.

1. Make a Point over every third Figure given, beginning at the Unit's Place, feek the greatest Cube to the first Point on the Lest Hand (by the Table) whose Root, place in the Quotient, then subtract its Cube from the Period, and to the Remainder (if any) bring down the three Figures, or your next Period, and call it your Dividend.

2. Find a Divisor by calling your Quotient Figure, with a Cypher joined to it r; then three Times the Square of r will be your Divisor; seek how often it is contained in the Dividend, and put the Answer in the Quotient as in Division, only with this Difference: call the said Quotient Figure last put up e, and multiply your Divisor by it, and place the Produce underneath the Dividend, then multiply the Square of e, by three Times r, and place it also under the Dividend; sassey, cube the Figure you called e, and place it under the Dividend: then add the three Product together, gives the Subtrahend, which subtract from you sassey and proceed as before.

- 1. What is the Cube Root of 21024576?
- 2. Extract the Cube Root of 92398647.
- 3. What is the Cube Root of 2716243264?
- 4. What is the Cube Root of 91?

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- 5. What is the Cube Root of 67527834239?
- 6. Extract the Cube Root out of 4764,75.
- 7. The Solidity of a Cube is 36155,027576 Inches, what is the Side of that Cube?
- 8. What is the Side of that Cube, which contains 67667,921875 folid Inches?
- 9. What is the Cube Root of 219365329?
- 10. What is the Cube Root of 3105926,917?
- 11. What is the Cube Root of ,000421875?
- 12. What is the Side of a Cube, whose Solidity is 28022810,390625?
- The Biquadrate of any Number is found, by extracting the Square Root of the given Number first, and then the Square Root of that Root.
- 13. Let it be required to extract the Biquadrate of 4857532416.
- The Root of the Square cubed, or fixth Power of any Number, is found by extracting the Square Root of the given Number, then extract the Cube Root of that Square Root, which will give the fixth Power required.
- 14. Let it be required to extract the Square cubed Root of 49656.
- The Root of the Biquadrate squared, or eighth Power, is found by first extracting the Square Root of the given Number, which will reduce it to a Biquadrate, which proceed with as before directed.
- 15. Let it be required to extract or find the Root of the eighth Power out of 43046721.
- The Root of the Cube cubed, or ninth Power of any Number, is found by extracting the Cube Root of the given Number, and the Refult will be a cubic Resolvend, or extract the Cube Root also, which will be the Root of the ninth Power.

16. Let it be required to extract or find the Root of the ninth Power of 387420489.

The extraction of the first and second Sursolids, i. e. the fifth and seventh Powers, will prove too difficult a Task in common Numbers; I would therefore advise the Tutor to teach his Pupils only the Square and Cube Roots here, as they are the most useful, and, in short, as high as is required in all common Things. Besides, the Reason of the Thing cannot be shewn till the Pupil comes to the Algebraic Part, where it will be easily performed, and appear more evident.

To extract the CUBE ROOT of a VULGAR FRACTION.

Note.—The same Rules, with regard to Fractions, which are given in Page 175, must be observed here, only extracting the Cube Root instead of the Square; that is, reduce the Fractions to their lowest Terms; if it be a mixed Number, to an improper Fraction; and if a Surd, to a Decimal.

EXAMPLES.

1. What is the Cube Root of T 5 24?

2. What it the Root of $\frac{352}{1188}$?

3. What is the Cube Root of 5\frac{104}{25}?

4. What is the Cube Root of $405\frac{28}{125}$?

SURDS.

5. What is the Cube Root of 53?

6. What is the Cube Root of 73?

53. The USE of the CUBE ROOT.

CASE I.

To find the Side of a Cube that shall be equal in Solidity to any given Solid, as a Globe, Cylinder, Prism, Cone, &c.

RULE.

Extract the Cube Root of the folid Content of the given Body, which Root will be the Side of the Cube required.

EXAMPLE

1. There is a Stone of a cubic Form, which contains 21925 folid Feet; what is the superficial Content of one of its Sides?

CASE II.

Having the Dimensions of any solid Body, to find the Dimensions of another similar Solid, that shall be any Number of Times greater or less than the Solid given.

RULE.

Multiply the Cube of each Side by the Difference between the Solid given and that required, if greater (or divide by the Difference if less) than the Solid given; then extract the Cube Root of each Product or Quotient, which will give the Dimensions of the Solid required.

EXAMPLES.

2. Suppose the Length of a Ship's Keel to be 125 Feet, the Breadth of the Midship Beam 25 Feet, and the Depth of the Hold 15 Feet; I demand the Dimensions of another Ship of the same Form, that shall carry three Times the Burthen?

3. Again, I demand the Dimensions of another Ship of the fame Form, that shall only be Half the Burthen of that whose Dimensions are given as above?

CASE III.

Having the Dimensions and Capacity of a Solid, to find the Dimensions of a similar Solid of a different Capacity.

RULE.

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E.

Like Solids are in triplicate Portion to their homologous Sides, therefore it will be as the Cube of a Dimension: is to its given Weight:: fo is the Cube of any like Dimension: to the Weight fought.

4. If a Ship of 300 Tons Burthen be 75 Feet long in the Keel, I demand the Burthen of another Ship, whose Keel is 100 Feet long?

5. Suppose a Ball of 4 Inches Diameter weighs 18lb. I demand the Diameter of another that weighs 114lb.

6. If a Brass Saker, whose Diameter is 11,5 Inches, weighs 1000lb. what will another Piece of Ordnance (of the same Metal and Shape) weigh, whose Diameter is 20,83 Inches?

CASE IV.

To find two mean Proportionals between two given Numbers.

RULE.

Divide the greater Extreme by the less, and the Cube Root of the Quotient, multiplied by the less Extreme, gives the lesser Mean; multiply the said Cube Root by the lesser Mean, and the Product will be the greater mean Proportional.

EXAMPLES.

- 7. What are the two mean Proportionals between 7 and 189?
- 8. Find two mean Proportionals between 4 and 256.

54. The SINGLE RULE of THREE in DECIMALS.

RULE.

Reduce the Fractional Parts into Decimals of the highest Name mentioned; then state the Question, and proceed as in Sect. 12, and 13.

EXAMPLES.

- 1. Suppose I give 6s. 3d. for $4\frac{3}{4}$ Yards of Cloth; what will $48\frac{1}{2}$ yds. of the same come to at that Rate?
- 2. If $2\frac{1}{2}$ lb. of Tea cost 11. 53, what will $14\frac{3}{4}$ lb. come to at the same Rate?
- 3. If 1 lb. of Sugar cost 113d. what will 4 hhds. each weighing

The Single Rule of Three in Decimals. weighing Net 4 cwt. 2 grs. 14 lb. cost at the same Rate?

4. A Grocer buys 4 Chests of Tea, each weighing Net 2 cwt. 3 qrs. 14 lb. for 9061. 10s. at what Rate did he

give per lb.?

5. How far will a Person be able to travel in o Days, 8 Hours, at the Rate of 12 Miles every 4 Hours, allow-

ing 12 Hours to the Day.

6. An Oilman bought 4 Tuns 2017 Gallons of Florence Oil for 2401, 16s. 6d. but by Misfortune it chanced to leak out 242 Gallons: I defire to know at what he must fell the Remainder per Gallon, to be no Loser?

7. Goliah is faid to have been 6 Cubits and a Half, or a Span, high; this answers to 10 Feet 4 Inches and 774: Pray what was the Length of the Cubit in British Meafure?

QUESTIONS for Exercise at Leisure Hours.

8. In a Series of proportional Numbers, the first is 5, the third 8; the Product of the second and third is 78,4: What is the Difference of the Second and Fourth?

9. If the cubic Inch of Oil Olive be ,52835 Decimal Parts of an Ounce Avoirdupoife: What Quantity of Oil, weighing 7½ lb. per Gallon, will be contained in a Cask allowed to hold 131 Gallons of Water, each 282 folid Inches?

10. The cubic Inch of Marble is 1,5688 oz. Avoirdupoise; what Difference is there, in point of Weight, between a Figure containing a folid Foot and Half of Stone, and another of equal Dimensions in Brass 4,63 oz.

whereof make a cubic Inch?

11. There are two Numbers, the leffer 75, to which the greater is in Proportion as 8 to 5: What is their Sum, and the Product of their Sum and Difference, the Difference and Product of their Squares, and the Sum of the Square of their two Quotas, the greater divided by the less, and again the less by the greater?

12. There are two Numbers more, the greater 224, bearing Proportion to the other as 8 to 7: What is the Square of their Sum, Difference, and either Quota? What is the Refult of the Square of the Sum of the Difference,

186 The Single Rule of Three in Decimals.

Difference, added to the Product of their Sum and Difference?

13. If during the Tide of Ebb, a Wherry should set out from London westward, and at the same Instant another should put off at Chertsey for London, taking the Distance by Water at 34 Miles: the Stream forwards one and retards the other, say, 2½ Miles an Hour: The Boats are equally laden, the Rowers equally good, and in the ordinary Way of working, in still Water, would proceed at the Rate of 5 Miles an Hour: The Question is, where in the River the two Boats would meet?

14. A Bullet of cast Iron, 4 Inches Diameter, weighs experimentally 9 lb. What is the Difference of the Weight of one that is 13½ Inches in Diameter, and another

that is no more than 7½ Inches?

15. A gay young fellow had 182001. left him by an old Uncle, to whose Memory he expended three per Cent. of his whole Fortune, in a sumptuous Funeral and Monument; 9 per Cent. of the Remainder he made a Present of to his Cousins, forgotten for his Sake by the old Man; with \(^2\) of what was left, he bought a fine Seat; with \(^1\) of the Residue a Stud of Horses; he squandered away 5501. upon one Mistress; and after he had lived at the Rate of 20001. a Year for 19 Months together, he hath both ruined his Health and impaired his Fortune: Pray, at his Death, what was there left for his Sister, who was his Heir at Law?

The Effects of LIGHT and HEAT.

The Effects or Degrees of Light, Heat, and Attraction, are reciprocally proportional to the Square of their Diftances from the Center whence they are propagated.

16. Suppose that in a Room, where two Men, A. and B. are sitting, there is a Fire, from which A. is three Feet, and B. is six Feet distant; it is required to find how much hotter it is at A.'s Seat than at B.'s.?

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17. Supposing the Earth to be 81000000 Miles distant from the Sun; I would know at what Distance from him another Body must be placed, so as to receive Light and

Heat double to that of the Earth?

18. The Distance between the Earth and Sun is accounted

81000000 of Miles, the Distance between Jupiter and the Sun 424000000 of Miles, the Degree of Light and Heat received by Jupiter, compared with that of the

Earth is required?

19. Mercury, the nearest of the Planets to the Source of Heat, Light, and Life in our System, the Sun, is about 32 Millions of Miles from him; Saturn, the remotest of the Planets, is usually distant about 777 Millions of Miles: What Comparison or Proportion is there between the Solar Influences on these two Bodies?

20. Suppose, with Dr. Keil, the Distance of the Sun to be from us 115 of his Diameters; how much hotter is it then at the Surface of the Sun than under our Equator?

of a Tower, was observed to fall Half the Way in the last Second of Time: Required the Tower's Height, and the whole Time of Descent?

The less porous a Body is, the greater is its Density.

22. The Compactness or Density of the Moon is to that of the Earth, as 132½ is to 100: What Proportion then is there between the Quantity of Matter in the Earth and that in the Moon, since the Earth's Diameter is 7970

Miles, and that of the Moon 2170?

Inhabitants the Moon doth always appear to be most enlightened when she is least enlightened, and to be least when most, according to Gordon's Geographical Grammar: Admitting the mean Distance of the Earth and Moon's Centers 240000 Miles, in what Proportion is this Illumination?

Velocities acquired by heavy Bodies falling.

The Velocity acquired by heavy Bodies falling near the Surface of the Earth is $16\frac{1}{2}$ Feet in the first Second, and as $16\frac{1}{2}$ Feet are to the Square of one Second, or 1, so is the given Distance to the Square of the Seconds required; or, on the contrary, to determine what Space a heavy Body has passed in any Time given, is,

By multiplying 16½, the Descent of a heavy Body in one Second of Time, by as many of the odd Numbers, begin-

ning from Unity, as there are Seconds in the given Time, viz. by t for the first, 3 for the second, 5 for the third, 7 for the fourth, &c. the Sum Total will give the Space it hath passed.

24. Suppose a Stone let go into an Abys s should be stopped at the End of the eleventh Second after its Delivery, what Space would it have gone through?

Wells, into each of which should a Stone be dropped at the same Instant, one will meet with the Bottom at 6 Seconds, the other at 10?

26. If a Stone be 19½ Seconds in descending from the Top of a Precipice to the Bottom, what is the Height of the same?

27. In what Time would a Musquet-Ball, dropped from the Top of Salisbury Steeple, said to be 400 Feet High, be at the Bottom?

28. If a Hole could be bored through the Center of the Earth, in what Time after the Delivery of a heavy Body on its Surface, would it arrive at its Center?

50. The DOUBLE RULE of THREE in DECIMALS.

Reduce the Fractional Parts to Decimals, and then proceed as in Sect. 14.

EXAMPLES.

1. If 11. 25. worth of Wine will suffice a Club of 12 Persons, when the Wine is fold at the Rate of 251. 45. per hhd. how many Persons will 11. 125. worth serve, when the Wine is fold after the Rate of 18 Guineas per hhd.?

2. If 6lb. of Pepper be Worth 13lb. of Ginger, and 19lb. of this be worth 4\frac{1}{4}lb. of Cloves, and 10lb. be equivalent to 63 lb. of Sugar at 5d. per lb. what is the Value of 1 cwt. of Pepper?

3. What Money, at 3\frac{1}{2} per Cent. will clear 381. 2s. 6d. in 2
Year and a Quarter's Time?

QUESTIONS for Exercise at Leisure Hours.

4. A. lent his good Friend B. fourfcore and eleven Guineas, from the 11th of December to the 10th of May follow-

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ing; B. on another Occasion, let A. have roo Marks, from September 3 to Christmas following: Query, how long ought the Person be obliged to let his Friend use 401. fully to retaliate the Favour?

5. A. B. and C. will trench a Field in 12 Days; B. C. and D. in 14; C. D. and A. will do it in 15; and D. A. and B. in 18; in what Time will it be done by all of

them together, and by each of them fingly?

6. A young Hare starts 5 Rods before a Greyhound, and is not perceived by him till she has been up 34 Seconds; she scuds away at the Rate of 12 Miles an Hour, and the Dog, on View, makes after her at the Rate of 20: How long will the Course Hold, and what Ground will he run, beginning with the Out-setting of the Dog?

VIBRATIONS of PENDULUMS.

It hath been found by Experiment, that a Pendulum 39.2 Inches long, in our Latitude, vibrates 60 Times in one Minute; and that the Length of the Pendulums are to one another reciprocally, as the Square of the Number of their Vibrations made in the same Space of Time.

7. What Difference is there between the Length of a Pendulum that vibrates Half a Second, or 120 Times in a Minute, and another that swings double Seconds, or 30 Times in a Minute?

8. What Difference will there be in the Number of Vibrations made by a Pendulum of 6 Inches long, and another of 12 Inches long, in an Hour's Time?

9. What Difference is there in the Length of two Pendulums, the one fwinging 30 Times, the other 100 Times in an Hour?

10. Give the Length of a Pendulum that will fwing once in a Third, ditto in a Second, ditto in a Minute, ditto

in an Hour, ditto in a Day?

11. Observed, that while a Stone was descending to measure the Depth of a Well, a String and Plummet, that from the Point of Suspension, or the Place where it was held, to the Center of Oscillation, or that Part of the Bob, which being divided by the circular Line, struck from the Center above said, would divide it into two Parts

of equal Weight, measured just 18 Inches, had made 8 Vibrations: Pray what was the Depth, allowing 1150 Feet per Second for the Return of Sound to the Ear?

55. FELLOWSHIP.

How to perform Fellowship, either Single or Double, without that tedious and laborious Task of making so many different Statings, as there are Persons concerned.

RULES.

1. Divide the whole Gain or Loss by the whole Stock.

2. The Quotient multiplied by each Person's particular Stock, and the several Products will be the respective Gain or Loss of each.

Note .- This Rule is best adapted for Decimals.

EXAMPLES.

1. Three Persons making a joint Stock, A. puts in 750l.

B. 450l. and C. 300l. with which they trade a certain Time; and, when they Balance Accounts, find that they have gained 300l. What is the Share of each?

2. Three Merchants, A. B. and C. traded together; A. puts in 1201. for 8 Months, B. 2501. for 4 Months, and C. 1001. for 5 Months; they gained 1841. 105. What is

each Man's Share of the Gain?

3. Once as I walked upon the Banks of the Rye,
 To fee the purling Streams glide gently by,
 And hear the pretty Birds to chirp and fing,
 Making the Groves with Melody to ring;
 I, in the Meads, three beauteous Nymphs did fpy,
 That for their Pleafure came as well as I;
 And unto me their Steps they did direct,
 Saluting me with most benign Respect,
 Saying, Well met, we've Business to impart,
 Which we cannot decide without your Art:
 Our Grannum's dead, and left a Legacy,
 Which is to be divided amongst three;

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In Pounds it is two hundred twenty-nine,
Also a good Mark, being Sterling Coin.
Then spake the eldest of the lovely three,
I'll tell you how it must divided be;
Likewise our Names I unto you will tell,
Mine is Moll, the others Anne and Nell.
As oft as I five and five-ninths do take,
Anne takes four and three-sevenths her Part to make;
As oft as Anne sour and one-ninth does tell,
Three and two-thirds must be took up by Nell.

For more Examples, fee Sect. 25. and 26.

Of Simple Interest, Annuities or Pensions, &c.

56. I. SIMPLE INTEREST.

Here are five Letters to be observed, viz.

P=any Principal or Sum put to Interest. I=the Interest.

T=the Time of the Principal's Continuance at Interest.

A=the Amount, or Principal and its Interest. R=the Ratio, or Rate per Cent. per Annum.

Note.—The Ratio is the Simple Interest of 11. for one Year, at any given Rate; and is thus found,

l. l. l. l. Viz. 100:5::1:,05 the Ratio at 5 per Cent. per Ann. Or, 100:6::1:,06 the Ratio at 6 per Cent. per Ann.

And in this Manner the Ratios in the following Table are found.

TABLE.

3 = 0.03	4=,045
3=,035	5 =,050
4 =,04	$5\frac{1}{2} = ,055$

1. When the Principal, Time, and Rate per Cent. are given, to find the Interest.

RULE.

RULE.

Multiply the Principal, Rate, and Time, continually, into one another, the Product is the Interest fought.

Or, if p= the Principal, t= the Time, r= the Rate, and I= the Interest, then the Theorem will be as follows.

THEOREM I. ptr=I.

EXAMPLES.

1. What is the Interest of 2601. 17s. 6d. for $5\frac{1}{2}$ Years at $4\frac{1}{2}$ per Cent. per Annum?

2. What is the Interest of 500l. from May the 12th, 1784, to November the 24th, 1789, at 3\frac{3}{4} per Cent. per Ann.?

2. When the INTEREST required is for DAYS only.

RULE.

Multiply the Interest of 11. for one Day, at the given Rate, by the Principal and Number of Days, it will give the Answer.

The Interest of 11. for one Day, is thus found,

d. 1. d. 1.

Viz. As 365: ,05:: 1:,0001369863, &c. Or 365:,035:: 1:,00009589041, &c.

TABLE.

Iper Cent.	Decimals.
	00008219178
3=,	00009589041
	00010958904
4=	00012328767
5 =,	0001369863

EXAMPLES.

3. What is the Interest of 3701. 10s. for 220 Days at 41 per Cent. per Annum?

4. What is the Interest of 6001. from the 1st of July, 1784, to the 24th of February following, at 6 per Cent.?

When

When the Principal Term, and Rate per Cent. are given, to find the Amount.

RULE.

Find the Interest by Theorem 1, which, added to the Principal, will give the Amount.

Thus, THEOREM 2. ptr-p=A.

EXAMPLES.

5. What will 2841. 105. amount to in 7 Years, at 3\frac{x}{2} per Cent. per Annum?

6. What will 6721. 55. amount to in $5^{\frac{1}{2}}$ Years, at $4^{\frac{1}{2}}$ per Cent. per Annum?

7. What will 5001. amount to in 6 Years 120 Days, at 43 per Cent. per Annum?

When the Rate, Time, and Interest are given, to find the Principal.

RULE.

Divide the Interest by the Product of Rate and Time, the Quote is the Principal.

Thus, Theorem 3. $\frac{I}{tr} = p$.

EXAMPLES.

8. I demand what Principal, being put to Interest for 3 Years, will gain 691. 13s. 6d. at 5 per Cent. per Ann.?

9. I demand what Principal, being put to Interest for $5\frac{1}{2}$ Years, will gain 641. 7s. at $4\frac{1}{2}$ per Cent. per Ann.?

10. I demand what Principal, being put to Interest for 4 Years, at 4 per Cent. will gain 671. 151. 934.?

When the Amount, Rate, and Time are given, to find the Principal.

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Add I to the Product of the Rate and Time, and by that Sum divide the Amount, the Quote is the Principal.

Thus, THEOREM 4. $\frac{a}{tr+1} = p$.

S EXAMPLES.

3541. 4s. ½d. in 7 Years, at 3½ per Cent. per Annum?

12. What Principal, being put to Interest, will amount to 500l. 9s. 3½d. in 6 Years 5 Months, at 5 per Cent. per Annum?

13. What Principal, being put to Interest for 7 Years 220 Days, at 4\frac{3}{4} per Cent. per Annum, will amount to 100%.

When the Principal, Interest, and Rate are given, to find the Time.

RULE.

Divide the Interest by the Product of the Principal and Rate, the Quote is the Time.

Thus, Theorem 5.
$$\frac{I}{pr} = t$$
.

EXAMPLES. *

14. In what Time will 4641. 10s. gain 691. 13s. 6d. at 5 per Cent. per Annum?

15. In what Time will 2601. gain 641. 7s. at 4½ per Cent.

per Annum?

16. In what Time will 500l. gain 130l. 9s. 7d. at $6\frac{1}{2}$ per Cent. per Annum?

When the Principal, Interest, and Rate are given, to find the Time.

RULE.

Divide the Amount less the Principal, by the Product of the Principal and Rate, the Quote is the Time.

Thus, Theorem 6. $\frac{a-p}{pr} = t$.

EXAMPLES.

17. In what Time will 284l. 10s. amount to 354l. 4s. ½d. at 3½ per Cent. per Annum?

18. In what Time will 6721. 5s. amount to 8471. 17s. 6dat $4\frac{3}{4}$ per Cent. per Annum?

19. In what Time will 3781. 18s. amount to 5001. 9s. 3 d. at 5 per Cent. per Annum?

When the Principal, Interest, and Time are given, to find the Rate per Cent.

RULE.

Divide the Interest by the Product of the Principal and Time, the Quote is the Rate.

THEOREM 7. Thus
$$\frac{I}{pt} = r$$
.

EXAMPLES.

- 20. At what Rate per Cent. will 4641. 10s. gain 691. 13s. 6d. in 3 Years?
- 21. At what Rate per Cent. will 2601. gain 641. 7s. in 5\frac{\tau}{2}
 Years?
- 22. At what Rate per Cent. will 560l. 12s. 8½d. gain 235l. 9s. 4d. in 7 Years?

When the Principal, Amount, and Time are given, to find the Rate.

RULE.

Take the Difference between the Amount and Principal, and divide it by the Product of the Principal and Time, the Quote is the Rate.

Thus, THEOREM 8.
$$\frac{a-p}{pt} = r$$
.

EXAMPLES.

- 23. At what Rate per Cent. will 2841. 10s. amount to 3541. 4s. \frac{1}{2}d. in 7 Years?
- 24. At what Rate per Cent. will 3781. 18s. amount to 5001. 9s. 3\frac{1}{4}d. in 6 Years?
- 25. At what Rate per Cent. will 6721. 55. amount to 8471. 175. 6d. in 5½ Years?

57. Of ANNUITIES, PENSIONS, &c. in ARREARS, At SIMPLE INTEREST.

An Annuity is a yearly Income arising from Money, &c. and is either paid for a Term of Years, or upon a Life.

Annuities or Pensions are said to be in Arrears, when they are payable or due either Yearly, Half-Yearly, or Quarterly, and are unpaid for any Number of Payments.

Here U represents the Annuity, Pension, or yearly Rent,

A, T, R, as before.

When U, R, T, are given, to find A.

THEOREM 9.
$$\frac{ttu-tu}{2} \times r : +tu = A$$
.

When the Annuity, &c. is to be paid Half-Yearly, or Quarterly, then for Half-Yearly Payments, take Half the Ratio, Half the Annuity, &c. and twice the Number of Years; and for Quarterly Payments take a fourth Part of the Ratio, a fourth Part of the Annuity, and four Times the Number of Years, which work with as per Theorem.

EXAMPLES.

26. If 250k yearly Rent, Pension, &c. be forborn or unpaid 6 Years, what will it amount to in that Time, at 3 per Cent. for each Payment as it becomes due?

27. If a Salary of 2501. payable every Half-Year, remain unpaid for 6 Years, what would it amount to in that

Time, at 3 per Cent. per Annum?

28. If a Salary of 2501. payable every Quarter, was left unpaid for 6 Years, what would it amount to in that Time, at 3 per Cent. per Annum?

It may be observed by comparing the Answers of the three last Examples, that the Half-Yearly Payment is more advantageous than the Yearly one, and also the Quarterly more than the Half-Yearly.

When A, R, and T, are given, to find U.

THEOREM 10.
$$\frac{2a}{ttr-tr+2t}$$
=U.

When

n

When the Payments are Half-Yearly, take 4a; if Quarterly, 8a; and proceed with the Ratio and Time as before.

EXAMPLES.

29. If a Salary payable Yearly amounts to 16121. 10s. in 6 Years, at 3 per Cent. what is the Salary?

30. The Amount of a Salary payable Half-Yearly for 6 Years, at 3 per Cent. is 16231. 155. what is the Salary?

31. If the Amount of an Annuity, payable Quarterly, be 16291. 75. 6d. for 6 Years, at 3 per Cent. what is the Annuity?

When U, A+ and T, are given, to find R.

THEOREM 11.
$$\frac{2a-2ut}{utt-ut}$$
=R.

When the Payments are Half-Yearly, take 4a-4ut for a Dividend; if Quarterly, take 8a-8ut, and proceed with the Annuity and Time as is mentioned in Theorem 9.

EXAMPLES.

32. If a Salary of 2501 per Annum, amounts to 16121. 10s. in 6 Years, what is the Rate per Cent.?

33. If a Salary of 250l. per Annum, payable Half-Yearly, amounts to 1623l. in 6 Years, what is the Rate per Cent.?

34. Suppose a Pension of 2501. per Annum, payable Quarterly, amounts to 16291. 75. 6d. in 6 Years, what is the Rate per Cent.?

When U, A, and R, are given, to find T.

THEOREM 12. First
$$\frac{2}{r}$$
 -1=X. Then $\sqrt{\frac{2a}{ur} + \frac{xx}{4}}$; $-\frac{x}{2}$ =T.

When the Payments are Half-Yearly or Quarterly, proceed with the Ratio and Annuity as mentioned before; and T will be equal to those Half-Yearly or Quarterly Payments.

EXAMPLES.

35. In what Time will a Salary of 2501. per Annum amount to 16121. 10s. at 3 per Cent.?

36. If an Annuity of 2501. per Annum payable Half-Yearly amounts to 16231. 155. at 3 per Cent. what Time was the Payments forborn?

37. If an Annuity of 2501. per Annum, payable Quarterly, amounts to 16291. 7s. 6d. at 3 per Cent. what was the Time of Forbearance?

58. PRESENT WORTH of ANNUITIES, &c.

Here P represents the present Worth; U, T, and R, as before.

When U, T, and R, are given, to find P.

THEOREM 13.
$$\frac{\overline{ttr-tr+2t}}{2tr+2}$$
: $\times U=P$.

The fame is to be observed here for Half-Yearly and Quarterly Payments, as before mentioned.

EXAMPLES.

- 38. What is the present Worth of 2501. per Annum, to continue 6 Years?
- 39. What is a Pension of 2501. per Annum worth in ready Money, payable Half-Yearly, at 3 per Cent. for 6 Years?
- 40. What is the present Worth of 2501. payable Quarterly, for 6 Years, at 3 per Cent.?

When P, T, and R, are given, to find U.

THEOREM 14.
$$\frac{tr+1}{ttr-tr+2t}$$
: $\times 2p=U$.

When the Payments are Half-Yearly, multiply by 4 p; for Quarterly, by 8 p; and proceed with t and r as before directed.

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EXAMPLES.

41. What Annuity is that, which for 6 Years Continuance produces 1366l. 10s. 6d. prefent Worth, at 3 per Cent.?

42. There is an Annuity, payable Half-Yearly, for 6 Years to come; what is the yearly Income, when the present

Worth, at 3 per Cent. is 13761. 55.?

43. There is an Annuity, payable Quarterly, for 6 Years to come; what is the yearly Income, when the present Worth is 1380l. 17s. 6d. at 3 per Cent.?

When U, P, and T, are given, to find R.

THEOREM. 15.
$$\frac{ut-p\times 2}{2pt+ut-utt}$$
=R.

When the Payments are Half-Yearly, or Quarterly, proceed with the Annuity and Time as before directed, and the Quotient will be the Answer accordingly; i. e. if for Half-Yearly, the Quotient will be Half the Ratio, and if for Quarterly, a fourth Part of the Ratio.

EXAMPLES.

44. At what Rate per Cent. will an Annuity of 2501. per Annum, to continue 6 Years, produce the present Worth of 13661. 10s. 6d.?

45. If an Annuity of 250l. per Annum, payable Half-Yearly, having 6 Years to come, is fold for 1376l. 5s.

what is the Rate per Cent.?

46. At what Rate per Cent. will an Annuity of 2501. per Annum, payable Quarterly, to continue 6 Years, produce 13801. 17s. 6d. for the present Worth?

When U, P, and R, are given, to find T.

THEOREM 16. First
$$\frac{2 2p}{r u}$$
 $1=x$.

Then $\sqrt{\frac{2p}{ur} + \frac{xx}{4}} = t$.

Simple Interest.

When the Payments are Half-Yearly or Quarterly, proceed with the Annuity and Ratio as before directed, and the Quotient will be the Number of Payments.

EXAMPLES.

- 47. If an Annuity of 2501. per Annum produces 13661. 10s. 6d. for the prefent Worth at 3 per Cent. what is the Time of its Continuance?
- 48. An Annuity of 250l. per Annum, payable Half-Yearly, is fold for 1376l. 5s. at 3 per Cent. I defire to know the Number of Payments and Time to come?
- 49. Suppose a Lease of a House of 250l. per Annum, payable Quarterly, is fold for 1380l. 17s. 6d. at 3 per Cent. I demand the Number of Payments and Time to come?
 - 59. ANNUITIES, &c. taken in REVERSION.

CASE I.

To find the present Worth of an Annuity taken in Reversion.

RULES.

- of the yearly Sum at the given Rate, and for the Time of its Continuance.
- 2. Change P into A, and find what Principal being put to Interest will Amount to A at the same Rate, and for the Time to come, before the Annuity, &c. commences.

THEOREM 17.

1. Thus
$$\frac{ttr-tr+2t}{2tr+2}$$
: \times U=P.

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2. Thus
$$\frac{a}{tr+1} = P$$

EXAMPLES.

- 50. What is the present Worth of 250l. per Annum, to continue 6 Years, but not to commence until the End of A Years, allowing 2 per Cent, to the Purchaser?
- 4 Years, allowing 3 per Cent. to the Purchaser?
 51. What is the present Worth of a Lease of 801. per Annum,

num, to continue $7\frac{1}{2}$ Years, but not to commence until the End of 5 Years, allowing $4\frac{1}{2}$ per Cent. to the Purchaser?

52. There is a Legacy of 401. per Annum, for 10 Years, left to a Person of 14 Years of Age; the Time of Payment is not to commence till the said Person's Age be 21; but he wanting a Sum of Money, is minded to sell the same at 5 per Cent. I demand the present Worth?

To find the yearly Income of an Annuity, &c. in Reversion.

RULES.

r. Find the Amount of the present Worth at the given Rate, and for the Time of its Continuance.

2. Change A into P, and find what Annuity being fold will produce P at the fame Rate, and for the Time of its Continuance.

1. Find the Amount of the Thus Theorem 18.ptr+p=A.

Thus
$$\frac{tr+1}{ttr-tr+2t}$$
: $\times 2p=U$.

EXAMPLES.

Months, but does not commence till the End of 4 Years, has disposed of it for the present Payment of 12201. 25. 23d. allowing 3 per Cent. to the Purchaser; what is the yearly Income?

54. There is a Lease of a House taken for $7\frac{1}{2}$ Years, but not to commence until the End of 5 Years, the Lessee would fell the same for 419l. 15s. $1\frac{1}{4}d$. present Payment, allowing $4\frac{1}{2}$ per Cent. to the Purchaser; what is the yearly Rent?

55. There is a Legacy of a certain Rate per Annum, for 10 Years, left to a Person of 14 Years of Age; but the Time of Payment is not to commence till the said Person's Age be 21 Years; but he wanting a Sum of Money, sold it for 2411. 195. 6,074d. allowing 5 per Cent. to the Buyer, I demand the yearly Rate?

60. REBATE or DISCOUNT.

Here S represents the Sum to be discounted, P the present Worth, T and R as before.

When S, T, and R, are given, to find P.

THEOREM 19.
$$\frac{s}{tr+1} = P$$
.

EXAMPLES.

56. What is the present Worth of 1501. due 9 Months hence, at 5 per Cent.?

57. What is the present Worth of 1000l. due at 5 Months

at 4½ per Cent.?

58. What is the Discount of 93421 at 4 per Cent. for 10 Months?

When P, T, and R, are given, to find S. THEOREM 20. ptr--p=S.

EXAMPLES.

59. Suppose I receive 1441. 115. 634. now, for a Sum of Money due 9 Months hence, allowing 5 per Cent. for present Payment: I demand the Sum that was due at first?

60. If the present Worth of a Sum of Money due 3 Months hence, allowing 4½ per Cent. to be 9811. 105. 5d. what

was the Sum first due?

61. A Person paid 91111.35.8½d. for a Debt due 10 Months hence, he being allowed 4 per Cent. for the Discount, how much was the Debt?

When S, P, and R, are given, to find T.

THEOREM 21.
$$\frac{s-p}{pr}$$
=T.

EXAMPLES.

62. The present Worth of 150l. due for a certain Time to come is 144l. 12s. 6\frac{3}{4}d. at 5 per Cent. I demand in what Time the first Sum should have been paid, if no Rebate had been made?

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63. A Person receives 9811. 10s. 5d. for 1001. due at a certain Time to come, allowing 4½ per Cent. Discount; I desire to know in what Time the Debt should have been discharged without any Rebate?

64. I have received 91111. 35. 8½d. for a Legacy of 93421. allowing the Executor 4 per Cent. I demand when the

Legacy was payable without Rebate?

When S, P, and T, are given, to find R.

THEOREM 22:
$$\frac{\int -p}{pt}$$
 = R.

EXAMPLES.

65. At what Rate per Cent. will 1501. payable 9 Months hence, produce 1441. 115. 634d. for the present Payment?

66. At what Rate per Cent. will 1000l. payable at 5 Months hence, produce 981l. 10s. 5d. for the present Payment?

67. At what Rate per Cent. will 93421. payable 10 Months hence, produce 91111. 35. 82d. for the present Payment?

61. EQUATION of PAYMENTS.

To find the equated Time for the Payment of any Sum of Money, due at feveral Times.

RULES.

of each Payment for its | Thus Theorem 23. Theorem 23. Theorem 23. Thus Theorem 23. Theorem 23. Thus Theorem 23. The 2

2. Add all the present Worths together, and call that Sum P, then will s—p=D, the Rebate.

3. And $\frac{d}{pr}$ = E, the true equated Time.

EXAMPLES.

68. B. owes C. 1400l. which was to have been paid as follows; 400l. down, 500l. at the End of 6 Months, 250l. at the End of 8 Months, and the Rest at the End of 10 Months;

Months; but they agree to have but one Payment of the whole, Rebate at $3\frac{1}{2}$ per Cent. the true equated Time is demanded?

69. In what Time will the Interest of 491. 3s. equal the Proceed of 121. 6s. at Use 47 Days, at any Rate of Interest?

70. Put out 3841. to Interest, and in 8½ Years there were 5421. 8s. found to be due; what Rate of Interest could then be implied?

62. COMPOUND INTEREST.

The Letters made use of here, are,

A, the Amount.

P, the Principal.

T, the Time.
R, the Amount of 11. for 1 Year, at any given Rate, which is found by the following Proportion.

Thus, As $\int 100 : 105 : : 1 : 1,05 = \mathbb{R}$, at 5 per Cent.

100: 106:: 1: 1,06=R, at 6 per Cent. &c.

The Construction of the first Table following, shewing

the Amount of 11. for any Number of Years under 31, at 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, and 5 per Cent.

Thus the Amount of 11. for 2 Years, at 5 per Cent. compound Integers, will be 1,05×1,05=1,1025.

Also, $1,05\times1,05\times105=1,157625=$ the Amount of 11.

for 3 Years, at 5 per Cent.

And the Construction of the second Table is by the Continual Multiplication of the Amount of 11. for a Day; the Amount of 11. for a Day being the Root of its Amount for a Year, extracted to the 365th Power.

The Amount of 11. for a Day at 5 per Cent. is 1,0001336, its Amount for 2 Days will be 1,0001336×1,0001336
=1,0002672, &c. and 1,0001336×1,0001336×
1,0010336=1,0004011, the Amount of 11. at 5 per Cent. for 3 Days compound Interest.

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TABLE I.

The Amount of One Pound for Years.

Years.	3 per Cent.	3½ per Cent.	4 per Cent.	41 per Cent.	5 per Cent.
1	1,0300000	1,0350000	1,0400000	1,0450000	1,0500000
2	1,0609000	1,0712250	1,0816000	1,0920250	1,102 5000
3	1,0927270	1,1087178	1,1248640	1,1411661	1,1576250
4	1,1255088	1,1475230	1,1698586	1,1925186	1,2155063
5	1,1592740	1,1876863	1,2166529	1,2461816	1,2762816
6	1,1948523	1,2292553	1,2653190	1,3022601	1,3400956
7	1,2298733	1,2722792	1,3159318	1,3608618	1,4071004
8	1,2667700	1,3168090	1,368 5691	1,4221006	1,4744554
9	1,3047731	1,3628973	1,4223118	1,4860251	1,5513282
10	1,3439163	1,4105987	1,4862443	1,5529694	1,6288946
11	1,3842338	1,4599697	1,5394541	1,6228530	1,7103393
12	1,4257608	1,5110686	1,6010322	1,6958814	1,7958563
13	1,4685337	1,5639560	1,6650735	1,7721961	1,8856491
14	1,5125897	1,6186045	1,7316764	1,8519449	1,97993:6
15	1,5579674	1,6753488	1,8009435	1,9352834	2,0789282
16	1,6017064	1,7339860	1,8729812	2,0223901	2,1828746
17	1,6528476	1,7946755	1,9479005	2,1133768	2,2920183
18	1,7024330	1,8574892	2,0258165	2,2308478	2,4066192
19	1.7535060	1,9225013	2,1068492	2,3078603	2,5269502
20	1,8061112	1,9897888	2,1911231	2,4117140	2,6532977
21	1,8602945	2,0594314	2,2787681	2,5202411	2,7859626
22	1,9161034	2,1315115	2,3699188	2,6336520	2,9252607
23		2,2061144	2,4647155	2,7521663	3,0715238
24		2,2833284	2,5633042	2.8760138	3,2251000
25		2,3632449	2,6658363	3,0054344	3,3863549
26		2,4459585	2,7724697	3.1406709	3,5546527
27			2,8833685	3,2820095	3.7334563
28		2,6201719	2,9987033	3,4296999	3,9201291
29		2,7118779	3,1186514	3,5840364	4,1161336
30		2,8067937	3,2433975	3,7453181	4,3219424

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TABLE

TABLE II.

The Amount of One Pound for Days.

Days.	3 per Cent.	3½ per Cent.	4per Cent.	4½ per Cent	5 per Cent.
1	1,00008c9	7,0000942	1,0001074	1,0001206	1,0001336
2	1,0001619	1,0001885	1,0002149	1,0002412	1,0002973
3	1,0002429	1,0002827	1,0003224	1,0003618	1,0004011
4	1,0:03240	1,0003770	1,0004299	1,0004824	1,0005348
	1,0004050	1,0004713	1,0005374	1,0006031	1,0006685
5	1,0004860	1,0005656	1,0006449	1,0007238	1,0008023
7	1,0005670	1,0006600	1,0007524	1.0008445	1,0009361
8	1,0006480	1,0007542	1,0008600	1,0009652	1,0010699
9	1 0007291	1,0008486	1,0009675	1,0010859	1,0012037
10	1,0008101	1,0009429	1,0010751	1,0012066	1,0013376
20	1,0016209	1,0018867	1,0021512	1,0024148	1,0026770
30	1,0024324	1,0028315	1,0032288	1,0036243	1,0040182
40	1,0032445	1,0037771	1,0043074	1,0048354	1,0053611
50	1,0040573	1,0047236	1,0053871	1,0060479	1,0067059
60	1,0048708	1,0056710	1,0064680	1,0072618	1,0080525
70	1,0056849	1,0066193	1,0075501	1,0084773	1,0094009
80	1,0064996	1,0075685	1,0086333	1,0096942	1,0107511
90	1,0073151	1,0085186	1,0097177	1,0109125	1,0121031
100	1,0081311	1,0094696	1,0109803	1,0121324	1,0134563
110	1,0089479	1,0104214	1,0118900	1,0133537	1,0148125
120	1,0097653	1,0113742	1,0129779	1,0145765	1,0161699
130	1,0105834	1,0123279	1,0140670	1,0158007	1,0175291
140	1,0114021	1,0132825	1,0151572	1,0170265	1,0188932
150	1,0122215	1,0142379	1,0162487	1,0182537	1,0202531
160	1,0130415	1,0151943	1,0173412	1,0194824	1,0216178
170	1,0138623	1,0161516	1,0184350	1,0207126	1,0229843
180	1,0146837	1,0171098	1,0195299	1,0219442	1,0243527
190	1,0155057	1,0180689	1,0206261	1,0231774	1,0257228
200	1,0163284		1,0217233	1,0244120	1,0270949
210	1,0171518	1,0199897	1,0228218	1,0256481	1,0284687
220	1,0179759	1,0209315	1,0239215	1,0268858	1,0298444
230	1,0188006	1,0219142	1,0250223	1,0281249	1,0312219
340	1,0196260	1,02 28778	1,0261243	1,0293655	1,0326013
250			1,0272275	1,0306076	1,0339825

When

When P, T, and R, are given, to find A.

THEOREM I. p×rt=A.

1. By the foregoing Tables, thus, Multiply the Principal by the tabular Number for the given Time and Rate, and

the Product will be the Amount required.

If the Amount is required for any Number of Years or Days that are not in the Tables, then observe this Rule. Divide the given Number of Years or Days into such Numbers as are in the Tables, then multiply the Amounts answering to each, into each other, continually, and the Product by the Principal, which will be the Amount required.

EXAMPLES.

1. What will 2461. 105. amount to in 7 Years, at 5 per Cent. per Annum?

2. What will 5001. amount to in 30 Years or Days, at 42

per Cent.?

3. What is the Amount of 5231. in 5 Years and 194 Days, at 5 per Cent.?

When A, R, and T, are given, to find P.

THEOREM 2.
$$\frac{A}{R} = P$$
.

2. By the foregoing Tables, thus, divide the Amount by the tabular Number for the given Time and Rate, and the Quotient will be the Principal required.

EXAMPLES.

4. What Principal, or Sum of Money, must be put out to raise a Stock of 2431. 25. 4d. in 4 Years, at 5 per Centper Annum?

5. What Principal, being put to Interest, will amount to

3461. 17s. in 7 Years, at 5 per Cent. per Annum?
6. What Principal, being put to Interest for 30 Years at 4½ per Cent. per Ann. will amount to 18721. 13s. 2d.?

7. What Principal, being put to Interest for 5 Years and 194
Days, will amount to 6851. 72d. at 5 per Cent. per Ann.?
When

Compound Interest

When P, A, and R, are given, to find T.

THEOREM 3. $\frac{a}{p}$ =Rt. $\begin{cases} \text{which being continually divided by} \\ r, \text{ till nothing remains, the Number of those Divisions will be equal to T, the Time.} \end{cases}$

3. By the foregoing Tables, thus, Divide the Amount by the Principal, and the Quotient will be the Amount of 11. at the given Rate, which will be found under the Rate, even with the Time required.

EXAMPLES.

8. In what Time will 2461. 10s. amount to 3461. 17s. at 5 per Cent. per Annum?

9. In what Time will 530l. amount to 1872l. 135. 2d. at $4\frac{1}{2}$ per Cent. per Annum?

10. In what Time will 5231. amount to 6851. 7\frac{1}{2}d. at 5 per Cent. per Annum.

When A, P, and T, are given, to find R.

THEOREM 4. $\frac{\alpha}{p} = Rt$. which being extracted by the Rules of Extraction (the Time given to the Question shewing the Power) will give the Rate.

4. By the foregoing Tables, thus, proceed as with the last, and even with the given Time is under the Rate required.

EXAMPLES.

11. At what Rate per Cent. will 1461. 10s. amount to 3461.

17s. in 7 Years?

12. At what Rate per Cent. will 500l. amount to 1872l.

13s. 2d. in 30 Years?

13. At what Rate will 5231. amount to 6851. 7½d. in 5 Years and 195 Days?

70. ANNUITIES, PENSIONS in ARREARS.

Here U represents the Annuity, Pension, or yearly Rent, A, R, and T, as before.

The 3d Table shews the Amount of 1l. Annuity for any Number of Years under 31, at 3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, and 5 per Cent. and is thus constructed: Take the first Year's Amount, which is 1l. multiply it by 1,05+1=2,05=2d Year's Amount. Which also multiply by 1,05+1=3,1525=3d Year's Amount.

The 4th Table shews the present Worth of 11. due at any Number of Years, to commence under 31, Rebate at 3, $3\frac{1}{4}$, 4, $4\frac{1}{2}$, and 5 per Cent. And is made thus $1 \div 1$, 05, =, 952381 first Year's present Worth, and $952381 \div 1$, 05 = 9070, 295 = 20 Year's, and $90703 \div 1$, 05 = 8638376, the third Year's present Worth, &c.

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TABLE III.

The Amount of One Pound per Annum, or Annuity for Years.

Years.	3 per Cent.	3½ per Gent	4 per Cent.	4½ per Cent.	5 per Cent.
1	1.00000000	1.0000000	1.0000000	1.0000000	1.0000000
2	2.0300000	2.0350000	2.0400000	2.0450000	2.0500000
3	3.0909000		3.1216000	3.1370260	3.1525000
4	4.1836270	4.2149429	4.2464640	4.2781911	4.3101250
56	5.309135	5.3623659	5.4707097		
6	6.4684099				
8	7.6624622				
	8.8923360				
9	10.1591061				
	11.4638793				
		13-1419919			
		14.6019616			
13	15.0177904	16.1130303	16.6262397	17.1599133	17.7129828
14	17.0803242	17.6769864	18.2919112	18.9321094	19.5986320
15	18,5989139	19.2956809	20.0235870	20.7840543	21.5785030
10	20.1568813	20.9710297	21.8245311	22.7193367	23.0574918
1.7	21.7015877	22.7050158	23.6975124	24.7417009	25.8403004
18	23.4144354	24.4996912	25.0454129	20.8550837	28.1323847
19	25.1108084	26.3571805	27.0712294	29.0035025	30.5390039
20	20.8703745	28.2796818	29.7780780	31.3714228	33.0059541
2.1	28.0764857	30.2694707	31.9092017	33.7831308	35.7192518
22	30.5307803	32.3289022	34.2479098	30.5033779	38.5052144
23	32.4523837	34.4604137	30.0178880	38.9370299	41.4304051
		16.6665282			
25	30.4592043	38.9498567	41.0459003	44.5052101	47.7270908
20	30.5530422	41.3131017	44.3117440	47.570044	51.1134538
27	40.7090335	43.7590602	47-0642144	50.7113230	54.6691265
28	42.9309225	46.2906273	49.9075030	53.9933332	50.4025028
29	45.2185502	48.9107993	52.9002803	57.4230332	66 4299
30	47.5754157	51.6226773	50.0049277	01.0070007	00.4300475

TABLE IV.

The prefent Worth of One Pound for Years.

Years.	3 per Ct.	3½ per Ct.	4 per Ct.	4½ per Ct.	5 per Ct.
ī	,9708738	,9661836	,9615385	,9569378	,9523809
2	,9425959	,9331507	,9245562	,9157299	,9070295
3	,9151417	,9019427	,8889964	,8762966	,8638376
4	,8884870	,8714422	,8548042	,8385613	,822702
5	,8626088	,8419732	,8219271	,8024511	,7835262
6	,8374843	,8135006	,7903145	,7678957	,7462154
7	,8130915	,7859910	,7599178	,7348285	,7106813
8	,7894092	,7594116	,7306902	,7031851	,6768394
9	,7664167	,7337310	,7025867	,6729044	,6446089
10	,7440939	,7089188	,6755642	,6439277	,6139133
11	,7224213	,6849457	,6495809	,6161988	,5846703
12	,7013799	,6617833	,6245971	,5896639	,5568374
13	,6809513	,6394041	,6005741	,5642716	,5303214
14	,6611178	,6177818	,577475I	,5399729	,5050679
15	,6418619	,5968906	,5552645	,5167204	,4810171
16	,6231669	,5767059	,5339082	,4944693	,4581115
17	,6050164	,5572038	,5133733	,4731764	,4362967
18	,5873846	,5383611	,4936281	,4528004	,4155207
19	,5792960	,5201557	,4746424	,4333018	,3957340
20	,5536758	,5025659	,4563870	,4146429	,3768895
21	,5375493	,4855709	,4388336	,3967874	,3489424
22	,5218925	,4691506	,4219554	,3797009	,3418479
23	,5066917	,4532856	,4057263	,3633501	,3255713
24	,4919337	,4379571	,3901215	,3477035	,3100539
25	,4776056	,4231470	,3751168	,3327306	,2953028
26	,4636947	,4088378	,3606892	,3184025	,2812407
27	,4501891	,3950123	,3468166	,3046914	,2678483
28	,4370768	,3816543	,3334775	,2915707	,2550936
29	,4243464	,3687482	,3206514	,2790150	,2429463
30	,4119868	,3562784	,3083187	,2670000	,2315775

When

When U, T, and R, are given to find A.

THEOREM 5.
$$\frac{\mathbf{U}rt-u}{r-1} = \mathbf{A}$$
.

By Table III. thus, multiply the Annuity by the tabular Number for the given Time and Rate, and the Product will be the Amount required.

EXAMPLES.

14. What will an Annuity of 701. per Annum (payable yearly) amount to in 4 Years, allowing 4 per Ct. per Ann.?

15. If a Salary of 1001. per Annum, to be paid yearly, be forborne 6 Years, or unpaid, at 5 per Cent. per Ann. what is the Amount?

16. A Minor of 14 had an Annuity left him of 701. a Year, the Proceed of which, by Will, was to be put out, both Principal and Interest, yearly, as it fell due, at 3 per Cent. till he should attain to 21 Years of Age; the utmost Improvement being made of this Part of his Fortune, what had he then to receive?

17. If an Annuity of 301. per Annum, payable yearly, be omitted to be paid for 30 Years, at 3½ per Cent. what

is the Amount?

When A, T, and R, are given, to find U.

THEOREM 6.
$$\frac{ar-a}{rt-1}=U$$
.

By Table III. thus, divide the Amount given by the tabular Number for the given Time and Rate, and the Quotient will be the Annuity required.

EXAMPLES.

18. What Penfion being forborne 6 Years, at 5 per Cent. will amount to 6801. 3s. $9\frac{1}{4}d$. 6288?

19. What Annuity will amount to 5361. 7s. 53d. 45984 in 7

Years, at 3 per Cent.?

20. If the Payment of an Annuity be forborne 30 Years amount to 15481. 131. 74d. at 3½ per Cent. What is the Annuity?

When U, A, and R, are given, to find T.

THEOREM 7. $\frac{ar+u-a}{u}$ =Rt. { Which proceed with as in Theorem the 3d, which will give T the Time.

By Table III. thus, divide the Amount by the Annuity, and the Quotient will be the Amount of 11. at the given Rate, which will be found under the faid Rate even with the Time required.

EXAMPLES.

17. In what Time will a Salary of 1001. per Annum amount to 6801. 3s. 93d. at 5 per Cent.?

18. In what Time will an Annuity of 701. amount to 5361.

19. In what Time will 301. per Annum amount to 15481.
135. 74d. 45984 at 3½ per Cent.?

When A, U, and T, are given, to find Rt.

THEOREM 8.
$$\frac{ar}{u} rt = \frac{a-u}{u} = R$$
.

This being a very high Equation, it requires the Affist-

ance of Algebra to determine R by the Theorem.

By Table III. thus, proceed as in the last Rule, which will give the Annuity that 11. will purchase for the given Time, which will stand even with the said Time, and under the Rate required.

EXAMPLES.

20. At what Rate per Cent. per Annum will a Salary of 100l. per Annum amount to 686l. 3s. 94d. 6288 in 6 Years?

of 701. per Annum amount to 5361. 7s. 5\frac{1}{4}d. 45984 in

7 Years?

22. At what Rate per Cent. per Annum will a Salary of 301. per Annum amount to 15481. 135. 74d. 0264 in 30 Years?

63. PRE-

63. PRESENT WORTH of ANNUITIES, &c.

The 5th Table shews the present Worth of 11. Annuity for any Number of Years under 31, at 3, $3\frac{7}{2}$, 4, $4\frac{7}{2}$, and 5 per Cent. and is made thus, Divide 1 by 1.05 = .95238, the present Worth for the first Year, which $\div 1.05 = .90703$ added to the first Year's present Worth, = 1.85941, the second Year's present Worth again $.90703 \div 1.05$ and the Quotient added to 1.85948 = 2.72324 = third Year's present Worth, at 5 per Cent. &c.

The 6th Table shews the Annuity which 11. will purchase for any Number of Years under 31, at 3, 3½, 4, 4½, and 5 per Cent. and is constructed by finding the present Worth of 11. per Annum in the 5th Table, at the affigned Rate and Time, and dividing Unity or 1 thereby, the Quotient will be the Annuity, that 11. will purchase at the same Rate for

io Age out 12454 as industry subset in

the same Time.

TABLE

TABLE V.

The present Worth of One Pound per Annum or Annuity for Years.

Vears	3 per Cent.	3 per Cent.	4 per Cent.	41 per Cent.	5 per Cent.
1	0,9708738	0,9661836	0,9615385	0,9569378	0,9523809
2	1,9124697	1,8996943	1,8860947	1,8726678	1,8594104
3	2,8286114	2,8016370	2,7750910	2,7489644	2,7232480
4	3.7170984	3,6730792	3,6298952	3,5875257	3,5459505
5	4,5797072	4,5150524	4,4518223	4,3899767	4.3294767
6	5,4171914	5,3285530	5,2421369	5,1578725	5,0756921
7	6,2302829	6,1145439	6,0020547	5,8927009	5,7863734
8	7,0196922	6,8739555	6,7327448	6,5958861	6,4632128
9	7.7861039	7,6076865	7,4353314		7,1078217
10	8,5302028	8,3169053	8,1108955	7,9127182	7,7217349
11	9,5256241	9,0015510	8,7604763	8,3289169	8,3064142
12	9,9540040	9,6633343	9,3850733	9,1185808	8,8632516
13	10,6349553	10,3027585	9,9856473	9.6828524	9,3935730
14	11,2960734	10,9205203	10,5631224		9,8,86409
15	11,9379351	11,5174109	11,1183868	10,7395457	10,3796380
16	12,5611020	12,0941168	11,6522949		10,837769
17	13,1661185	12,6513206			
18	13,7535131	13,1896817	12,6592961	12,1599918	11,6895860
19	14.3237991	13,7098374			12,0853208
20	14,8774748	14,2124033	13,5903253		12,462210
21	15.4150241	14,6979742			12,8211527
22	15,9369166	15,1671248			13,1630026
23	16,4436084	15,6204105			13,4885739
24	16,9355421	16,0583676			
25	17,4131477	16,4815146			
26	17,8768420		15,9827678		
27	13,3270315	17.2853645	16,3295844	15,4513018	
28	18,7641082	17.6670188	16,6630618	15,7428735	
29	19,1884546		16,9837132		
30				16,2888885	

TABLE VI.

The Annuity which One Pound will purchase for any Number of Years.

Years.	3 per Cent.	3½ per Cent.	4 per Cent.	4½ per Cent.	5 per Cent.
1	1,0300000	1,0350000	1,0400000	1,0450000	1,0500000
2	,5226108	,5264005	,5301961	,5339976	,5378049
3	,35353041	,3569342	,3603485	,3637734	,3672086
4	,2690271	,2722511	,2754901	,2785437	,2820118
5	,2183546	,2214814	,2246271	,2277916	,2309748
6	,1845975	,1876682	,1907619	,1938784	,1970175
7	,1605064	,1635445	,1606096	,1697015	,1728198
7 8	,1424564	,1454767	,1485279	,1516097	,1547218
9	,1284339	,3314460	,1344930	,1375745	,1406901
10	,1172305	;1202414	,1232909	,1263788	,1295046
11	,1080775	,1110920	,1141490	,1172482	,1203889
12	,1004621	,1034840	,1065522	,1096662	,1128254
13	,0940295	,0970616	,1001437	,1032754	,1064558
14	,0885263	,0915707	,0946690	,0978203	,1010240
10	,0837666	,0868251	,0899411	,0931138	,0963423
16	,0796109	,0826848	,0858200	,0890154	,0922699
17	,0759525	,0790431	,0821985	,0854176	,0886991
18	,0727087	,0758168	,0789933	,0822369	,0855462
19	,0698139	,0729403	,0791386	,0794073	,0827450
20	,0672157	,0703611	,0735818	,0768761	,0802426
21	,0648718	,0680366	,0712801	,0746006	,0779961
22	0627474	,0659321	,0691988	,0725457	,075970
23	,0608139	,0640188	,0673091	,0706825	,0741368
24	,0590474	,0622728	,0655868	,0689870	,072470
25	,0574279	,0606740	,0640120	,0674390	,070952
26	,0559383	,0592054	,0625674		,069564
27	,0545642	,0578524	,6612385		,668291
28	,0532932	,0566029	,0600130		,067122
29	,0521147	,0554454	,0588799		,066045
30		,0543713	1 ,0578301	,0613915	,065061

3

3:

When U, R, and T, are given, to find P.

THEOREM 9.
$$u-\frac{u}{r!}: \div r-1=P$$
.

By Table V. thus, Multiply the Tabular Number for the given Time and Rate, by the Annuity, &c. the Product will be the present Worth required.

[The Examples in Theorem 7 and 8, page 213, numbered 17, &c. to 22, should have been 21, &c. to 26.]

X A M P L E S. E

27. What is the present Worth of an Annuity of 501. per Annum, to continue 8 Years at 5 per Cent.?

28. What is the present Worth of an Annuity or yearly Rent of 601. to continue 6 Years at 4 per Cent.?

29. What is the prefent Worth of a Pension of 1000l. per Annum, for zr Years, at 42 per Cent.?

When P, T, and R, are given, to find U.

THEOREM 10.
$$\frac{prt \times r - prt}{rt - 1} = U$$
.

By Table V. thus, Divide the present Worth by the tabular Number for the given Time and Rate, and the Quotient will be the Annuity required.

Or by Table VI. thus, Multiply the tabular Number (for the given Rate and Time) by the present Worth, and the Product will be the Annuity.

X A M P L E S.

30. If the present Worth of 3231. 3s. 21d. 368 were required for a Pension of 8 Years to come, at 5 per Cent. what was the Pension?

31. What Annuity or yearly Rent may be purchased for

3141. 10s. 63d. 08544 at 4 per Cent. for 6 Years?
32. Suppose the present Worth of a Pension for 21 Years, at 4½ per Cent. was 134041. 14s. 5½d. 944, what was the Pension?

en

When U, P, and R, are given, to find T.

THEOREM II. $\frac{u}{p+u-pr} = Rt$.

Which proceed with as in Theorem 3, will give T.

By Table V. thus, Divide the present Worth by the Annuity, and the Quotient will be the Amount of 11. at the given Rate, which will be found under the said Rate, even with the Time required.

EXAMPLES

33. How long may one have a Leafe of 501. yearly Rent for 3231. 35. 2½d. 361, allowing 5 per Cent. to the Purchaser?

34. If an Annuity of 60l. is purchased for 314l. 10s. 63d. 08544, at 4 per Cent. what Time ought it to continue?

35. I demand what Time a Lease of 1000l. may be purchased for, when the present Worth of 13404l. 14s. 5\frac{3}{4}d. is made at 4\frac{1}{2} per Cent.?

When U, P, and T, are given, to find R.

THEOREM 12.
$$\frac{u}{p} = \frac{u}{p} R^t + R^t - R^t + 1$$
.

This being a very high Equation, requires the Affistance of Algebra to determine R.

By Table V. proceed as in the last Rule, and the Quotient will be the Amount of 11. Annuity for the given Time, over which will be the Rate required.

EXAMPLES.

36. If an Annuity of 50% to continue for 8 Years, be purchased for 323%, 35. 2½d. 368, what Rate of Interest hath the Purchaser for his Money?

37. Suppose I give 3141. 105. 634. 08544, for an Annuity of 601. to continue 6 Years, at what Rate was Interest allowed?

38. If an Annuity of 1000l. to continue 21 Years be purchased for 13404l. 14s. 5½d. 944, what Rate of Interest is the Purchaser allowed for his Money?

64. ANNUITIES,

64. ANNUITIES, LEASES, &c. taken in REVERSION.

To find the present Worth of Annuities, &c. in Reversion.

RULES.

1. Find the present Worth of the Annuity, &c. at the given Rate, and for the Time of its Continuance, by Theorem 9.

2. Change P into A, and find what Principal being put to Interest will amount to P at the same Rate and Time to come before the Annuity commences, by Theorem 2, which will give the present Worth of the Annuity.

Thus,
$$U - \frac{u}{r} : \div r - 1 = P.$$

Thus
$$\frac{A}{K'} = P$$
.

By Table V. thus, Find the prefent Value of 11. per Annum, at the given Rate, both for the Time being, and also for that and the Time in Reversion added together, then fubtract the Time in being from the other, and multiply the Remainder by the Annuity, the Product will be the present Worth required.

XAMPLES.

- 39. What is the present Worth of a Reversion of a Lease of 801. per Annum, to continue 6 Years, but not to commence till the End of 2 Years, allowing 5 per Cent. to the Purchaser?
- 40. What ought a Person to give down in ready Money for the Reversion of 1000l. a Year, to continue 20 Years, on a Leafe which cannot commence till 5 Years are at an End, allowing the Purchaser 5 per Cent.?

To find the yearly Income of an Annuity taken in Reversion.

U 2

RULES.

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S,

1. Find the Amount of the present Worth at the given Rate, and for the Time Thus, pri=A. before the Annuity commences, by Theorem 1.

2. Change

2. Change A into P, and find what yearly Rent, &c. being fold, will produce P at the fame Rate, and for the Time of its Continuance, by Theorem 10.

Thus,
$$\frac{\overline{ptr} \times r - prt}{r^t - 1} = U$$
.

By Table V. thus, proceed as in the last Rule, and divide the present Worth by the Remainder, the Quotient will be the Annuity required.

EXAMPLES.

41. What Annuity, to be entered upon two Years hence, and then continue 6 Years, may be purchased for 3681. 6s. 1d. ready Money, allowing 5 per Cent. to the Purchaser?

42. Suppose the present Worth of a Lease of an Estate is 81321. 14s. 8d. 064, taken in Reversion for 20 Years, but not to commence till the End of 5 Years, allowing 5 per Cent. to the Purchaser; what is the yearly Rent?

65. REBATE or DISCOUNT.

Here S represents the Sum to be purchased. When S, T, and R, are given, to find P.

By the 4th Table, thus, Multiply the tabular Number for the given Time and Rate, by the Sum to be purchased, the Product will be the present Worth?

EXAMPLES.

43. What is the present Worth of 1501. payable 4 Years hence, at 5 per Cent.?

44. What is the present Worth of 7431. 4s. 9d. payable 6 Years hence at 4 per Cent.?

When P, T, and R, are given, to find S.

THEOREM 14. $p \times rt = S$.

By Table IV. thus, Divide the present Worth by the tabular Number for the given Time and Rate, and the Quotient will be the Sum to be purchased.

EXAMPLES.

45. If 1231. 85. 14d. be received for a Debt payable 4 Years hence, and an Allowance of 5 per Cent. to the Debtor for prefent Payment, what was the Debt?

46. If a Sum of Money due 6 Years hence produce 5871. 75. 9\frac{3}{4}d. 718, for prefent Payment, Rebate being made at 4 per Cent. I demand how much the Debt was?

When S, P, and R, are given, to find T.

THEOREM 15. $\frac{s}{p} = rt$. Which proceed with as in Theorem 3.

By Table IV. thus, Divide the Principal by the Sum to be purchased, and the Quotient will be the present Worth of 11. at the given Rate, which will be found under the Rate, and even with the Time required.

EXAMPLES.

47. A Person received 1231. 8s. 14d. for a Debt of 1501. Rebate being made at 5 per Cent. I demand in what Time the Debt was payable?

43. The present Payment of 5871. 7s. 9\frac{3}{4}d. 718, is made for a Debt of 7431. 4s. 9d. Rebate at 4 per Cent. I demand when the Debt was payable?

When S, P, and T, are given, to find R.

THEOREM 16. S = R'. { Which proceed with as in Theorem 4.

By Table IV. thus, Proceed as in the last Rule, and the Quotient will be the present Worth of 11. for the given Time, which will be found even with the Time, and under the Rate required.

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EXAMPLES.

49. The present Worth of 1501. payable 4 Years hence, is 1231. 8s. 14d. at what Rate per Cent. is the Rebate made at?

U 3

50. The

50. The Sum of 7431. 4s. 9d. is payable in 6 Years Time, and the present Value of that Sum is 5871. 7s. 9\frac{3}{4}d. 718, I demand at what Rate per Cent. the Rebate must be made?

66. PURCHASING Freehold or Real ESTATES

Is to find the present Worth of an Annuity, &c. to continue for ever.

When U, and R, are given, to find P.

THEOREM 17.
$$\frac{u}{r-1} = P$$
.

EXAMPLES.

51. Suppose a Freehold Estate of 5001. per Annum were to be fold; what is the Worth, allowing 5 per Cent. to the Buyer?

52. What is an Estate of 251. per Annum, to continue for ever, worth in present Money, allowing 4½ per Cent.

to the Buyer?

When P, and U, are given, to find R.

THEOREM 18.
$$\frac{P+u}{p}$$
=R.

EXAMPLES.

53. Suppose one gave 100001. for a Freehold Estate of 5001.

per Annum, what Rate per Cent. has the Purchaser for his Money?

54. If an Estate of 251. per Annum is bought for 5551. 115.

13d. what is the Rate per Cent.?

When P, and R, are given, to find U.

EXAMPLES.

55. Suppose a Person would lay out 100001. on a Freehold Estate, and so as to be allowed 5 per Cent. for his Money, what must be the annual Rent of such an Estate?

56. If

- 56. If a Freehold Estate is bought for 5551. 115. 14d. and the Allowance of 42 per Cent. is made the Buyer; what is the yearly Rent?
- 67. Purchasing FREEHOLD ESTATES in REVERSION.

To find the Worth of a Freehold Estate in Reversion.

RULES.

1. Find the Worth of the yearly Rent, &cc.

2. Change P into A, and find what Principal being put to Interest will Amount to A, at the fame Rate, and for the Time to come before the Eftate commences.

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to the mention Theo. 20. Thus

Thus $\frac{A}{R^t} = P$.

Majed brieders (8 18 a) / Pale. EXAMPLE.

57. What is an Estate of 5001, per Annum worth in ready Money, to continue for ever, but not to commence till the End of 4 Years, allowing 5 per Cent. to the Purchaser?

To find the yearly Rent of an Estate taken in Reversion.

RULES.

1. Find the Amount of the Worth of the Estate at the given Theo. 21. pxr=A. Kate, and the Time before it commences.

2. Change A into P, and find Prxrwhat yearly Rent being fold will produce P at the fame Rate.

E. 119.7 EXAMPL

58. A Freehold Estate is fold for 82271. 1s. 4d. which does not commence till the End of 4 years, the Buyer being allowed 5 per Cent. for his Money: I defire to know the yearly Income?

QUESTIONS

QUESTIONS for EXERCISE.

So. Held of a College of 4861. 10s. a Year, on a referved Rent of 941. Money being at 5 per Cent. Interest; what Fine ought severally to be paid on a 7, a 14, and a 21 Year's Lease?

60. Suppose I would add 5 Years to a running Lease of 15 Years to come, the improved Rent being 1861. 7s. 6d. per Annum; what ought I to pay down in ready Money for this Favour, discounting 4 per Cent.?

61. A. has a Term of 7 Years in an Estate of 501. per Annum; B. hath a Term of 14 Years in the same Estate; and C. hath a farther Term of 10 Years after B. in the same Estate: What is the present Value of the several Interests in the said Estate?

62. For a Lease of certain Profits for 7 Years, A. offers to pay 1501. Gratuity, and 3001. per Annum; B. offers 4001. Gratuity, and 2501. per Annum; C. bids 6501. Gratuity, and 2001. per Annum; and D. offers 18001. for the whole Purchase, without any yearly Rent: Query, which is the best Offer, and what Difference, computing at 4 per Cent.?

63. Value the Lease of a House in tolerable Repair, the Rent 541. 175. a Year, the Ground Rent 7 Guineas, 3 Years of it only to come, the Rent payable every 6 Months, Discount per Compound Interest on this kind

of purchase at 101. per Cent.?

64. A Fine for a Lease of a Tenement is settled at 153l. under a reserved Rent of 16l. a Year: Now the Tenant cannot conveniently pay more than 50l. but for the 6 Years to come of the Term, is willing rather to pay an adequate Rent, computing 10l. per Cent. per compound Interest; what ought that Rent to be?

65. Another Lease for 7 Years is agreed for at 250l. Fine, on the old Rent 44l. a Year; but considering the Contractor desires to reduce the Rent to 20l. a Year, and pay a proper Fine, computing, as before, after the Rate of 10l. a Year; to what must the Fine be advanced?

66. A Son, previous to his Marriage, is minded to have 50l a Year Freehold fettled on his Family, and to have immediate Possession of it, offers his Father in Lieu an Annuity.

Annuity, for his Life, valued at 12 Years Purchafe, Discounting at 4 per Cent. thereon; whereas he is content the Estate should be valued at a Discount of 3 per Cent. and consequently will be worth $33\frac{1}{3}$ Years Purchase: Pray what had the Father for his Life?

67. A Gentleman took a College Leafe of 2371. a Year, for 21 Years, and paid the full Fine; the Rent referved was 101. a Year, but when 4 Years were elapsed, against the Marriage he renewed the Lease, and filled up the 21 Years. In 14 Years after that his Wife dying, he again renewed it in favour of his Daughter, then 7 Years of Age; and by the Time she was 19, it was a third Time renewed in order to her Settlement: The Question is, what Money the Society must have received from this Family from first to last, allowing 51. a Year Discount on the Fines?

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TUTOR'S GUIDE.

PART IV.

68. MENSURATION.

GEOMETRICAL DEFINITIONS.

Fig

Fig.

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GEOMETRY contains the Nature and Properties of Lines, Angles, Surfaces, and Solids.

A Point is that which has no Parts or Magnitude. A Line is Length conceived without Breadth.

An Angle is the mutual Inclination of two Lines which meet.

When a strait Line, as CD, (Fig. 4.) standing upon another, AB, makes the Angles, ADC, and CDE, on each Side equal to one another, each of these equal Angles is called a right Angle, and the dotted Line CD, is said to be perpendicular to the Line AB.

An Angle is commonly expressed by three Letters, that placed at the angular Point being always wrote in the Middle, as ADC (Fig. 4.) denotes the Angle, b.

An obtuse Angle is that which is greater than a right Angle, as CAB, (Fig. 3.)

An acute Angle is that which is less than a right Angle, as DCB, (Fig. 4.)

Parallel

Parrallel Lines are those of which every Point of the one is at the same Distance from the other, as the Lines AB, and CD, (Fig. 2.)

A Superficies, or Surface, is an Extension of two Dimen-

fions, viz. Length and Breadth.

A Plane or Plane Superficies, is that with which a right

Line may every Way coincide.

A Plane Superficies receives feveral Denominations, according to the Number and Politions of the Lines by which it is terminated, as follows:

Fig. 1. A Square is a right-angled equilateral Parallelogram, whose four Sides are equal, and its Angles all right ones.

A Quadrangle is a Figure made by four strait Lines.

Fig. 2. A Parallelogram is a Quadrangle whose opposite Sides are parallel.

An Oblong, or Rectangle, is longer than broad; but its opposite Sides are equal, and all its Angles right ones.

A Khombus, or Diamond Figure, is a Parallelogram whose Sides are all equal, but its Angles are not right Angles.

Fig. 3. A Rhomboides is an oblique angled Parallelogram, whose opposite Sides and Angles only are equal.

A Triangle is a Space included by three Lines, and of confequence hath three Angles; for every rectilineal plane Figure hath as many Angles as Sides.

A right-angled Triangle, is that which has one right

Angle, as Fig. in Page 177.

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Fig. 4. An equilateral Triangle, is that whose three Sides are all equal to each other.

An isosceles Triangle, is that which has only two of its

Sides equal to one another.

A Scalene Triangle, is that which has all its Sides unequal.

An obtufe-angled Triangle, is that which has an obtufe Angle.

An acute-angled Triangle, is that which has every Angle acute.

ig. 5. A Trapezium is a Quadrangle, whose opposite Sides are not parallel.

All

All right-lined Figures, having more than four Sides, are called Polygons, and receive their Names from the Number of their Sides or Angles.

Fig. 6. Having five Sides or Angles is called a Pentagon.

A regular Polygon, is a Figure with equal Sides and equal Angles.

Fig. 7. A Circle is a plane Figure bounded by a curve Line called the Circumference, every Part whereof is equally distant from a Point within called the Center.

A Diameter, AB, of a Circle, is a right Line drawn through the Center, and terminated by the Circumference.

The Semi-Diameter, AC, is called the Radius.

A Semi-Circle, is a Figure contained under a Diameter, and that Part of the Circumference of a Circle cut off by that Diameter, as the Line AB divides the Circle into two Semi-Circles.

Fig. 8. A Segment is any Part of a Circle terminated by an Arc, ADB cut off by the Line AB, called the Chord.

Fig. 9. A Sector of a Circle, is a Portion contained between two right Lines or Semi-Diameters, and the intercepted of the Circumference.

Fig. 10. Represents the Front of an Arch built with Stones of equal Length, and is a Segment of a Sector.

The hollow Side, AB, of a Curve, is called Concave, and

the raifed Side, CD, Convex.

Fig. 11. An Ellipsis, or Oval, is a Figure bounded by a regular curve Line, returning into itself, but of its two Axis cutting each other in the Center, one of which is longer (called the transverse Axis) than the other (called the conjugate Axis.)

A Solid is that which hath Length, Breadth, and Thickneis.

Fig. 12. A Cube is a Solid bounded by fix equal Squares.

Fig. 13. A Prism is a Solid whose Sides are Parallelograms, and whose two Ends are parallel to each other.

Fig. 14. A Cylinder is a round Solid, like the Rolling-Stone of a Bowling-Green, whose two Ends are equal and parallel Circles.

Fig. 15. A Pyramid is a Solid, whose Base is a Polygon, or right-lined Figure, and whose Sides or Triangles meet in a Point, C, called the Vertex.

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- Fig. 16. A Cone is a round Pyramid, or Pyramid having a circular Base, in form like a Sugar Loaf.
- Fig. 17, 18. A Frustum of a Pyramid or Cone, is that Part which remains, when any Part next the Vertex is cut off by a Plane parallel to the Base.
- Fig. 19. A Wedge is a Solid, having a rectangular Base, DB, and two of the opposite Sides ending in an Acies or Edge, EF.
- Fig. 20. A Pavilion is a Solid contained under 5 Planes; the Base is a Rectangle or Oblong, and the tour Sides terminate in a Ridge, EF, parallel to a Side of the Base, AB, or CD, but unequal to it.
- Fig. 21. A Prifmoid is a Solid contained under fix Planes; the Bases, or Ends, are parallel Rectangles, and the four Sides are Quadrangles.
- Fig. 22. A Sphere is a Solid bounded by a convex Surface, every Point of which is equally distant from a Point C, within, called the Center.
 - The Axis, or Diameter of a Sphere, is the right Line,
- Fig. 23. A Segment of a Sphere, is a Part cut off by a Plane, AB. If the Plane, pass through the Center of the Sphere, it will cut it equally in two, and each Half is called a Hemisphere.
- Fig. 24. A Spheroid is a Solid resembling an Egg, and is the Body conceived to be generated by the Revolution of an Ellipse about its Axis, and is denominated either prolate (oblong) or oblate, according as the Revolution is made about the transverse Axis or its conjugate.
 - The Axis about which the Revolution is made is the fixed Axis, the other is the revolving Axis.
- Fig. 25. A parabolic Spindle is eight-fifteenths of its circumfcribing Cylinder.
- Fig. 26. Is the middle Frustum of a Spheroid.

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68. SUPERFICIAL MEASURE.

PROBLEM I.

To multiply Feet, Inches, and Parts, by Feet, Inches, and Parts, which Method is termed Cross Multiplication, but more properly Duodecimal.

RULE.

Set the Feet in the Multiplier under the least Denomination in the Multiplicand, and the Rest in Order, beginning with the least Denomination; divide each Product by 12, as you go on; place the first Remainder under the multiplying Figure, and the Rest in Order, adding each Quotient to the next arising Product, as in Sect. 9. and having thus finished Multiplication, the Sum of all will be the Product required.

In general, thus,

When Feet are concerned, the Product is of the same De.

nomination with the Term multiplying Feet.

When Feet are not concerned, the Name of the Product will be expressed by the Sum of the Indices of the two Factors.

EXAMPLES.

1. Multiply 17 Feet, 7 Inches, by 6 Feet.

2. Multiply 47 Feet, 8 Inches, by 8 Feet, 4 Inches.

3. Multiply 7 Feet, 10 Inches, by 8 Feet, 6 Inches.

4. Multiply 64 Feet, 7 Inches, by 4 Feet, 8 Inches.

5. Multiply 12 Feet, 8 Inches, 9 Parts, by 9 Feet, 6 Inches, 7 Parts.

6. Multiply 9 Feet, 11 Inches, 6 Parts, by 11 Feet, 8 Inches.
7. Multiply 64 Feet, 10 Parts, by 14 Feet, 9 Inches.

8. Multiply 124 Feet, 4 Inches, by 42 Feet, 9 Seconds.

9. Multiply 16 Feet, 7 Inches, 10 Parts, by 6 Feet, 5 Inches, 7 Seconds.

3.

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70. Multiply 474 Feet, 6 Inches, 8 Seconds, by 186 Feet, 7 Inches, 4 Seconds.

11. Multiply 24 Feet. 11', 8", 6", 7", by 8 Feet, 6', 7".
12. Multiply 46 Feet, 6 In. 8", 4", by 6 Feet, 4 In. 8", 6".

PROBLEM II.

To find the Area of a Parallelogram, whether it be! Square, a Rectangle, a Rhombus, or a Rhomboides.

RULE.

Multiply the Length by the Height or perpendicular Breadth, and the Product will be the Area.

If the Area of a Piece of Ground, in Yards, is divided by 4840 (the Number of square Yards in one Acre) the Quotient will give the Number of Acres in the said Piece. Or,

If the Area in Links, be divided by 100000 (the Number of square Links in one Acre) the Quotient will give Acres.

Fig. 1.

That is, AB×AC=the Area.

Fig. 2.

Fig. 3.

Fig. 3.

E X A M P L E S.

1. What is the Area in Acres of a Parallelogram whose
Length is 14,5 Chains, and its Breadth 9,75 Chains.

2. What is the Area of a Square, whose Side is 245 Yards or Chains, &c.

3. How many square Yards of Paving are there in a Court-Yard, being in the Form of a Rhombus or Rhomboides, whose Length is 64 Feet, 6 Inches, and perpendicular Breadth is 47 Feet, 8 Inches?

PROBLEM III.
To find the Area of a Triangle:

R U L E S.

1. Multiply one of its Sides by the Perpendicular let fall upon it from its opposite Angle, and Half the Product will be the Area.

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2. Multiply the Base by Half the Perpendicular, or Perpendicular by Half the Base, and the Product gives the Area.

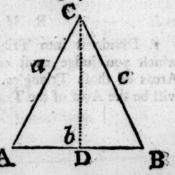


Fig. 4.

Superficial Measure.

That is, ABXCD = the Area.

EXAMPLES.

4. How many Acres are in a triangular Field, whose Base is 28, and Perpendicular 20,5 Chains?

5. A triangular Field 738 Links long, and 583 in the Perpendicular, brings in 121. a Year. What is it let at per Acre?

When the three Sides of a Triangle are given, to find the Area.

RULE.

3. From Half the Sum of the three Sides fubtract each Side feverally; multiply the Half Sum and the three Remainders continually together, and the Square Root of the last Product will be the Area of the Triangle, that is, $\frac{a+b+c}{2}$ = s=Half the Sum of the Sides.

Then let s-a=e, and s-b=f, also s-c=g; $c = \sqrt{sefg}$ = the Area.—Note. a=A C, b=A B, and c=B C. See the last Figure.

EXAMPLE.

6. Suppose I have a Fish-Pond of a triangular Form, whose three Sides measure 400, 348, and 312 Yards; what Quantity of Ground does it contain.

PROBLEM IV.

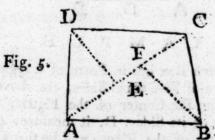
To find the Area of a Trapezium.

RULES.

vhich you judge most convenient; then the Sum of the Areas of those Triangles, calculated by the last Problem, will be the Area of the Trapezium. Or,

2. Multiply

the Ha 2. Multiply the Sum of the Perpendiculars by Half the Diagonal, and the Product will give the Area; or multiply the Sum of the Perpendicular by the Diagonal, and Half the Product will be the Area.



Or, 3. Subtract severally each Side from Half the Sum of the four Sides, and the square Root of the Product of the four Remainders will be the Area required.

EXAMPLES.

7. How many square Yards of Paving are there in a Trapezium, ABCD, whose Diagonal, BD, 45 Feet, and the Perpendiculars, AE, equal to 17,25, CF, equal to 14 Feet?

8. Suppose the four Sides of a Trapezium are 15,60; 13,20; 10, and 26 Chains: Quere, the Area?

PROBLEM V.

To find the Area of any regular Polygon.

RULEL

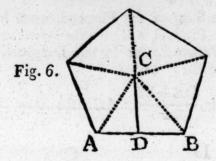
Let fall a Perpendicular from the Center of the Figure to one of its Sides, then multiply together the Perpendicular, the Side of the Figure, and the Number of its Sides, and Half the Product will be the Area.

Here the Number of Sides is 5=N.

Then it is, $AB \times CD \times n$ = the Area.

e

Superficial Measure.



EXAMPLE.

9. A Piece of Garden Box lies in Form of a regular Pentagon, or Figure of Five equal Sides, (as above) each 48 Feet; and from the Center of the Figure, C, to the Middle of one of its Sides, D, it measures 41,57 Feet nearly, the Area of the Figure will be the Content of these five Triangles. Pray, what is that?

RULE II.

Multiply the Square of the Side of any regular Figure by the Multiplier standing opposite to its Name in the sollowing Table, and the Product will be the Area.

No. of Sides.	Names.	Multipliers.
3	Trigon or equal \(\Delta \)	0,433013
4	Tetragon or Square.	1,000000
5	Pentagon.	1,720477
6	Hexagon.	2,598076
7 8	Heptagon.	3,633912
8	Octagon.	4,828427
9	Nonagon.	6,181824
10	Decagon.	7,694209
* 11	Undecagon.	9,365641
12	Duodecagon.	11,196152

EXAMPLES.

10. What is the Area of an Hexagon, whose Side is 30?

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PROBLEM VI.

To find the Diameter and Circumference of a Circle, the one from the other.

RULES.

1. Multiply the Diameter by 3,1416, and the Product will be the Circumference. And therefore,

2. Divide the Circumference by 3,1416, and the Quotient will be the Diameter.

3. See Sect. 51, Case 3.

EXAMPLES.

12. If the Diameter of a Circle be 7, what is the Circumference?

13. What is the Diameter of a Circle whose Circumference is 22?

14. What is the Circumference of the Earth, supposing it to be perfectly round, and its Diameter is 8000 Miles?

PROBLEM VII.

To find the Area of a Circle.

RULES.

1. Multiply Half the the Circumference by Half the Diameter, and the Product will be the Area. Or,

2. Multiply the Square of the Diameter by ,7854, and the Product will be the Area. Or,

3. Multiply the Square of the Circumference by ,079574, and the Product will be the Area. Or,

4. Multiply the Square of the Semi-Diameter by 3,1416, and the Product will be the Area. Or,

5. Multiply the Circumference by the Diameter, and a fourth Part of the Product will express the Area.

III. ,7854, and 3,1416, are Areas of Circles whose Diameters are 1 and 2, and ,079577 is the Area of a Circle whose Circumference is 1; likewise 452, and 1,273239, are Squares of the Diameters of Circles, whose Areas are 355, and 1, and 12831 is the Diameter of a Circle, whose Area is equal to a Square whose Side is 1.

For

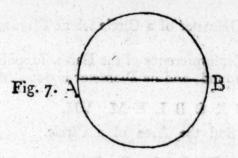
For if the Diameter be Unity or 1, the Circumference will be 3,1415926, then per Rule I. $\frac{3,1415926}{2} \times \frac{1}{2} =$,78539816, or rather ,7854, the Area. Also, if the Diameter be 2, the Circumference will be 6,2831853, then per Rule I. $\frac{6,2831853}{2} \times \frac{2}{2} = 3,1413926$, or ra-

ther, 3,1416, the Area. Likewise 3,1416 × 1:4=

,079477 the Area, &c.

Let C= the Circumference, and D= the Diameter, A.B.

Then per Rule I. $\frac{C}{2} \times \frac{D}{2}$ = the Area.



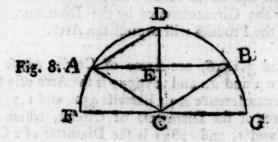
EXAMPLES

15. How many Square Feet are in a Circle whose Circumference is 6,2892?

16. What is the Area of a Circle whose Diameter is 12?

PROBLEM VIII.

To find the Length of any Arc of a Circle, ADB.



RULE.

a

RULE.

Multiply together the Radius, DC, the Number of Degrees in the given Arc, and the Number,01745329, (b) the last Product will be the Length of the Arc; for, when the Radius is 1, Half the Circumference is 3,14159265, &c.

and therefore, \(\frac{3.14159265}{180 \text{ Degrees}} = \, \cdot 01745329, \text{ or , } \cdot 0174533, \text{ nearly which is the Length of an Arch of 1 Degree.} \)

Hence CDXADBXb=the Length of the Arc, ADB.

EXAMPLE.

17. What is the Length of the Arc, ADB, which is 29,5 Degrees, and Radius 9.

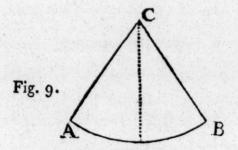
PROBLEM IX.

To find the Area of any Sector of a Circle.

RULE.

Multiply the Radius by Half the Arc of the Sector, found by the last Problem, and the Product will be the Area, as in the whole Circle.

That is, $AC \times \frac{AB}{2}$ = the Area.



EXAMPLE.

18. What is the Area of a Sector, whose Radius, CA, is 55, and the Length of the Arc, AB, 59.

E

PROBLEM X.

To find the Area of the Segment of a Circle, ADB, whose Center is E. (See Fig. 8.)

RULE.

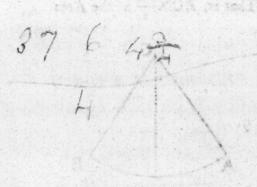
Find the Area of the Triangle ABC, by Prob. III. and of the Sector, ADBC, by the last Problem, their Difference, or Sum of these Areas, will be that of the Segment, according as it is less or greater than a Semi-Circle.

To fix Times the Base AB, (see Fig. 8.) add eight Times the Chord of Half the Arch AB, viz. AD, multiply the Sum by the Altitude DE, divide the Product by 15, and

the Quotient will nearly give the Area. Or, By the Table observe the following

RULE.

1. As the Diameter of any proposed Circle: is to 100 (the Diameter of the Tabular Circle): fo is the Height of any Segment of the proposed Circle: to a versed Sine in the Table.—Then, if the Tabular Segment, which stands against that versed Sine, be multiplied into the Circle's Area, the Product will be the Area of the Segment required.



TABLE

20

A TABLE of the Segments of Circles, whose Area is Unity or 1, the Diameter being divided by parallel Chord-Lines into 100 equal Parts.

7. S.	Segment.	V.S.	Segment.	v.s.	Segment.	v.s.	Segment
1	,0017	26	,2066	51	,5127	76	,8155
2	,0048	27	,2178	52	,5255	77	,8262
3	,0087	28	,2292	53	,5382	78	,8369
4	,0134	29	,2407	54	,5509	79	,8474
5	,0187	30	,2523	55	,5635	80	,8570
6	,0245	31	,2640	56	,5762	81	,8677
7 8	,0308	32	,2759	57	,5888	82	,8776
8	,0375	33	,2878	58	,6014	83	,8873
9	,0446	34	,2998	59	,614	11 04	,8968
10	,052	35	,3119	60	,6265	85	,9059
11	,0598	36	,3241	61	,6389	1 86	,9149
12	,068	37	1,3364	62	,6514	87	,9236
13	,0764	38	1,3486	63	,0030	88	,932
14	,0851	39	,3611	04	,6759	89	,9402
15	,0941	40	13735	65	,6681	90	,948
16	,1032	41	,3860	66	,7002	91	,9554
17	,1127	42	,3986	67	,7122	92	,9625
18	,1224	43	,4112	11 68	,7241	93	,9692
19	,1323	44	,4238	69	,736	94	9755
20	,1424	45	,4365	70	,7477	95	,9813
21	,1526	46	,4491	71	,7593	96	,9866
22	,1631	47	,4618	72	,7708	97	,9913
23	,17.28	48	14745	73	,7822	98	,9952
24	,1845	49	,4873	74	7934	99	,9988
25	1,1955	50	1,5	75.	1,8045	100	1,0000

EXAM, PLES.

19. Suppose the Diameter, FG, of a Circle to be 84 Inches, and the Height of the Segment, ED, 30 Inches, what will its Area be? (See Fig. 8.)

20. What is the Area of a Segment whose Arc is a Quadrant, or contains 90 Degrees, and Diameter 18 Feet?

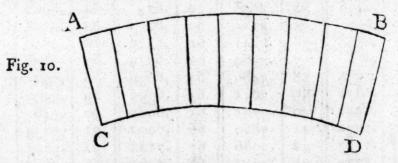
PROBLEM XI.

To find the Area of a Segment of a Sector, ABCD, or the Front of an Arch built with Stones of equal Length.

RULE.

Multiply Half the Sum of the bounding Arches, ABCD, by the Distance, AC, and the Product will give the Area.

That is, $\frac{AB+CD}{2} \times AC =$ the Area nearly.



EXAMPLES.

21. What is the Area of the Front of an Arch built with Stones 3½ Feet Long, whose upper and lower bounding Arcs are in Length 84 and 72½ respectively?

22. What is the Area contained between two concentric Semi-Circles, whose Diameters are 24 and 16?

PROBLEM XII.

To find the Area of an Ellipsis, or Oval.

RULE.

Multiply continually together the two Axis, and the Number, 7854 (b) and the Product of these three Numbers will express the Area.

That

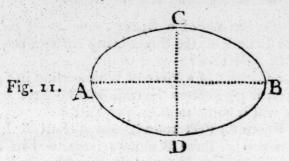
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That is, bXABXCD= the Area.



EXAMPLE.

23. What is the Area of an Ellipsis whose greatest Diameter is 24, and least Diameter 18?

OF ARTIFICERS WORKS.

I. GLAZIERS and MASONS FLAT WORK is measured by the Foot Square.

EXAMPLES.

3 Feet 10 Inches long, and 2 Feet 8 Inches broad: What will the Glazing come to at 8½d. per Foot?

2. There is a House with 3 Tier of Windows, 4 in a Tier, the Height of the first Tier is 6 Feet 6 Inches, the second 5\frac{7}{4} Feet, and the Third 4\frac{3}{4} Feet, the Breadth of each Window is 3 Feet 9 Inches. What will the Glazing come to at 16d. per Foot?

3. What is the Price of a Marble Slab whose Length is of $6\frac{\pi}{2}$. Feet, and Breadth $3\frac{\pi}{4}$ Feet, at 8s. per Foot?

4. A Looking Glass is 16 Inches by 9, and contains a Foot of Glass; what will the Content of the Plate be that has twice the Length, and three Times the Breadth?

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II. PAINTING, PLAISTERING, PAVING, &c. is measured by the Yard Square, which is 9 Square Feet.

RULE.

Divide the Square Feet by 9, and the Quotient will be the Number of Square Yards.

Y

EXAMPLES.

EXAMPLES.

5. What will the Paving of a Street come to at 6d. per Yard, the Length of the Street being 176½ Feet, and the Breadth 56¾ Feet?

6. What is the Content of a Piece of Wainscotting in square Yards, that is 9½ Feet in Height, and 8¼ Feet broad,

and what will it come to at 6s. per Yard?

7. There is a Room 84 Feet round, and 9 Feet 6 Inches high, in which are three Windows, each 6 Feet High and 3 Feet 5 Inches wide, and the Fire Place 4 Feet by 4 Feet; I demand how many Yards of Paper, Half-Yard wide, will hang it?

8. If my Court-Yard be 47 Feet 7 Inches square, and I have laid a Footway of Purbeck Stone 4 Feet wide along one Side of it; what will paving the Rest with

Flints come to, at 6d. per Yard square?

9. A rectangular four-fided Room measures 129½ Feet about, and is to be wainscotted at 3s. 6d. per Yard square; after the due Allowances for Girt of Cornice and Member, it is 16¼ Feet high; the Door is seven Feet by 3¾ Feet; the Window Shutters, two Pair, are 7¼ Feet by 4½ Feet; the Check Boards round them come 1¼ Foot below the Shutters, and are 14 Inches in Breadth; the lining Boards round the Door-Way are 16 Inches broad; the Door and Window Shutters being wrought on both Sides, are reckoned Work and Half, and paid for accordingly; the Chimney 3¾ Feet by 3 Feet, not being inclosed, is to be deducted from the superficial Content of the Room; and the Estimate of the Charge is required?

ro. What will Plaistering of a Ceiling, at 10½d. per Yard, come to, supposing the Length 34½ Feet, and the

Breadth 20 Feet?

Feet 8 Inches about, and 14½ Feet High; but is rendered between Quarters: The Lathing and Plaistering will be 8d. per Yard, and the Whiting 2d. per Yard; what will the Whole come to?

Note.—In measuring Plaistering, rendering between Quarters, there is commonly a Fifth Part of the whole Area deducted; but when rendering between Quarters is whited or coloured, there is commonly a fourth or fifth Part added to the whole Area, for Sides of the Quarters and Braces, &c.

III. FLOORING, PARTITIONING, ROOFING, TYLING, &c. is measured by the Square of 100 Feet.

In these Measurements, the Dimensions are taken by a Rod of 10 Feet long; and therefore the Result is in Squares of 100 Square Feet each.

Hence, dividing the Area in square Feet by 100, the

Quotient will be the Number of Squares required.

EXAMPLES.

12. In 120½ Feet in Length, and 12¾ Feet in Height of Partitioning, how many Squares?

13. What Difference is there between a Floor 28 Feet long, by 20 broad, and two others that measure 14 Feet apiece by 10; and what do all three come to, at 21.55.

per Square?

14. Suppose a House three Stories, besides the Ground Floor, was to be sloored, at 81. 10s. per Square; the House measures 30½ Feet by 20½ Feet; there are eight Fire Places, whose Measure are four of 6 Feet by 5¼, and four of 4¼ Feet, by 4, and the Well Hole for the Stairs is 10 Feet by 8½; what will the Whole come to?

15. How many Oaken Planks will floor a Room 60½ Feet long, and 33½ wide, supposing the Plank 15 Feet long,

and 11 wide?

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16. Suppose a House measures, within the Walls, 64 Feet in Length, and 36 Feet in Breadth, and to be of a true Pitch, what will it come to roofing, at 125. 6d. the Square?

17. Suppose I employ a Person to thatch a Barn, which is 70 Feet long, and 30 deep; I demand how many Squares are contained in the Whole; also what it will come to at 10s. 8d. per Square?

18. What will the new Ripping an Out-House cost, that measures 32\frac{3}{4} Feet long, by 22\frac{3}{4} broad, upon the flat, at 155. the Square; the Eaves Boards projecting 10

Inches on each Side?

Note.—In Tyling and Roofing, it is customary to reckon the Flat, and Half of any Building within the Walls, to be

the Depth or Width of the Roof of that Building; when the faid Roof is of a true Pitch, that is, when the Rafters are $\frac{3}{4}$ of the Breadth of the Building: But when the Roof is more or less than the true Pitch, they measure from one Side to the other.

IV. BRICKLAYERS WORK is measured by the Rod, of 2724 Square Feet.

This Work is always valued at the Rate of a Brick and a Half thick, and if the Thickness of the Wall is more or less, it must be reduced to that Thickness, by the following

RULES.

1. Multiply the Area of the Wall in Feet, by the Number of half Bricks in the Thickness the Wall is of; divide the Product by \$16\frac{3}{4}\$, and the Quotient will be the Content in Rods:—Or,

2. Multiply the Area of the Wall by the Number of half Bricks the Thickness of the Wall is of; the Product divided by 3, gives the Area in Feet, which divide by 2724, the Quotient will be the Rods required.

Note. The Fraction 3 in Rule 1, or 4 in Rule 2, is rejected

in Favour of the Workmen.

EXAMPLES.

rg. There is a Brick Wall 470 Feet round, and $9\frac{1}{2}$ Feet high, and three Bricks thick, how many Rods doth it contain?

20. A Gentleman built a Wall round his Garden, which is 840 Feet, and 9 Feet high, and 2 Bricks thick; how many Rods doth it contain, and what will it come to

at 41. 19s. 6d. per Rod?

21. The End Wall of a House is 24½ Feet in Breadth, and 40 Feet to the Roof; ½ of which is two Bricks thick, ½ more 1½ Brick thick, and the Rest 1 Brick thick: Now the Gable rises 38 Course of Bricks (4 of which usually make a Foot in Depth) and this is but 4 Inches, or half a Brick thick: What will this Piece of Work come to, at 51. 103. Statute Rod?

QUESTIONS for Exercise in Superficial Measure.

1. An Elm Plank is 14¹/₄ Feet long, and I would have just a Yard Square slit off; at what Distance from the Edge must the Line be struck?

2. Having a rectangular Marble Slab, 58 Inches by 27, I would have a Foot square cut off, parallel to the shorter Edge; I would then have the like Quantity divided from the Remainder, parallel to the longer Side, and this alternately repeated till there should not be the Quantity of a Foot lest; what will the Dimension of the Remainder be?

3. Being about to plant 10584 Trees equally distant in Rows, the Length of the Grove must be 6 Times the Breadth: How many of the shorter Rows will there be?

4. A common Joist is 7 Inches deep, and 2½ thick: But I want a Scantling just as big again, that shall be three Inches thick: What will the other Dimensions be?

5. I have a square Girder 19 Inches by 11; but one Quarter of the Timber in it (provided it be 9 Inches deep) will serve: How broad will it be?

6. I have a wooden Trough, that, at 6d. per Yard, cost me 3s. 2d. painting within; the Length of it was 102 Inches, the Depth 21 Inches; what was its Breadth?

7. My Plumber has put 28 lb. per Foot square into a Cistern 74 Inches, and twice the Thickness of the Lead long, 26 Inches broad, and 40 deep; he has put three Stays within, across it 16 Inches deep, of the same Strength, and reckons 22s. per cwt. for Work and Materials: I being a Mason, have paved him a Workshop, 22 Feet 10 Inches broad, with Purbeck Stone, at 7d. per Foot, and upon the Balance I find there is 3s. 6d. due to him; what was the Length of his Workshop?

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8. The rectangular Powdering Trough of a Man of War measures 27 square Feet, 112 Inches; the Depth is 20 Inches, the Breadth 16: The Length is sought?

9. In 110 Acres of Statute Measure, in which the Pole is 16½ Feet long, how many Cheshire Acres, where the Customary Pole is 6 Yards long; and how many Yorkshire, where the Pole in Use is seven Yards in Length?

Y 3

10. I would fet 3584 Plants in Rows, each 4 Feet afunder. and the Plants 7 Feet a-part, in a rectangular Plot of

Ground: What Land will this take up?

11. The Paving of a triangular Court, at 18d. per Foot, came to 1001. the longest of the three Sides was 88 Feet; what then was the Sum of the other two equal Sides?

12. An ancient Bath was found of a triangular Form, the Sum of whose three equal Sides was 125 Feet; the Area of the Bottom is required?—See Prob. III. Rule III.

13. I would plant 10 Acres of Hop Ground, which must be done either in the Square Order, as the Number 4 stands on the Dice, or in the quincunx Order, as the Number 5; the three nearest Binds, in both Cases, must be fet lineally just 6 Feet afunder: How many Plants more will be required for the last Order than for the first, admitting the Form of the Plot to lay the most

advantageous for the Plantation in either Case?

14. A Summer House is a Cube of 10 Feet, in the clear Cornice of which projects just 15 Inches on a Side, and being of Timber and Stucco, the Sides are 6 Inches thick, fo that the whole Front of the Roof, from Out to Out, is 132 Feet; this is hipped from each of the Corners to the Center, and being truly Pediment Pitch, it rifes of the Front, or 3 Feet. I would, by Help of these Dimensions, measure the Slating without venturing to climb for more, and compute the Cost 3 d. per square Foot?

15. A triangular Bath, 6 Feet deep, is exactly inclosed by 3 square Pavilions, and rectangular, the Sum of whose Planes together make just 50 Poles: The Area of A, the less, is to that of B, the middle One, as 43 to 8; and the Sum of the Areas of A and C, the biggeft, is to that of B, as 81 to 4: How many Wine Hogsheads

of Water will this Bath receive?

16. I have an Orchard in the Form of a Quadrangle or Trapeze, containing 33 Acres, which being divided by a Diagonal, or Line from Corner to Corner, the Perpendicular of one of the Triangles is 430 Links, and the other 360: The Length of the faid Diagonal, or common Base of those Triangles, is required? 17. Give

17. Give the Area of a circular Bowling Green that is 16 Poles across the Middle, the Circumference being 3,1416 Times the Diameter of a Circle?

18. The furveying Wheel is fo contrived as to turn just twice in the Length of a Pole, or 16\frac{3}{4} Feet; what then

is the Diameter?

19. I would turf a round Plot, measuring 130 Feet about, and would know the Charges, at 4d. per Yard square?

20. I want the Length of a Line, by which my Gardener may strike a round Aurangerie, that shall contain just

Half an Acre of Land?

21. Agreed for an Oaken Curb to a round Well, at 8d. per fquare Foot; it is exactly 42 Inches in Diameter, within the Brick Work, and the Breadth of the Curb is to be 14½ Inches, what will it come to?

22. It is observed, that the extreme End of the Minute-Hand of a public Dial moves just 5 Inches in the Space of 34 Minutes: The Question is, what is the Length

of that Index?

23. A. B. and C. join for a Grinding Stone, 36 Inches in Diameter, Value 20s. toward which A. paid 7s. B. 8s. and C. 5s. the waste Hole through which the Spindle passed was 5 Inches square; to what Diameter ought the Stone to be worn, when B. and C. begin severally to work with it?

24. I demand what Difference there is in the Area of the Section of a round Tree, 20 Inches over, and its in-

fcribed and circumfcribed Squares?

25. Having paved a Semi-Circle Alcove with black and white Marble, at 25. 4d. per Foot; the Mason's Bill was just 10l.; what then was the Arch in Front?

26. What Proportion is there between the Arpent of France, which contains 100 square Poles of 18 Feet each, and the English Acre, containing 160 Square Poles of 16 Feet each, considering that the Length of the French

Foot is to the English, as 16 to 15?

27. In turning a one Horse-Chaise within a Ring of a certain Diameter, it was observed, that the outer Wheel made two Turns, while the Inner made but one: The Wheels were equally high, and supposing them fixed at the statutable Distance, or 5 Feet asunder on the Axle-tree; pray what was the Circumserence of the Track described by the outer Wheel?

28. Received

28. Required the Area of a Sector, (supposing one of the Divisions of a Wilderness) which being struck from a Center with a Line 30 Yards long, makes the Sweep, or circular Part, 63 Feet, is required?

29. If the Chord or Line drawn through the two Ends of the above Curve, be 15 Inches shorter than the Arch

Line, I demand the Segment?

30. Suppose the Ellipse in Grosvenor Square measures 840 Links the longest Way, and 612 across, within the Rails; and if the Curb Stones are 14 Inches thick; what Ground do they enclose, and what do they stand upon?

The Dimensions of all similar Figures are in Proportion to their Areas, as the Squares of their respective Sides, et contra.

31. If a round Pillar, 7 Inches over, has 4 Feet of Stone in it, of what Diameter is the Column, of equal Length, that measures ten Times as much?

32. A Pipe of 6 Inches bore will be 3 Hours in running off a certain Quantity of Water: In what Time will 4 Pipes, each 3 Inches bore, be in discharging double the Quantity?

33. Suppose a Yard of Rope 9 Inches round, weighs 22lb. what will a Fathom of that weigh which measures a

Foot about?

34. If 20 Feet of Iron Railing shall weigh Half a Ton when the Bars are an Inch and Quarter square; what will 50 Feet of ditto come to, at 3½d. per lb. the Bars being but ½ of an Inch square?

35. A Sack that holds three Bushels of Corn is 22½ Inches broad when empty; what would the Sack contain, that being of the same Length, had twice its Circumserence,

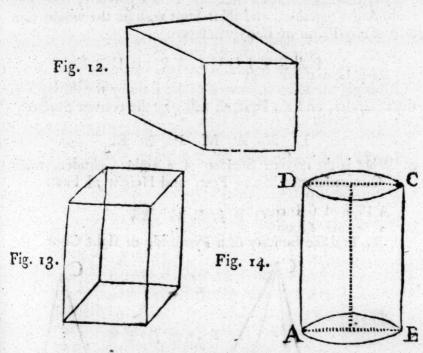
or twice its Breadth?

36. My Plumber has fet me up a Cistern, and his Shop-Book being burnt, he has no Means of bringing in the Charge, and I do not chuse to take it down to have it weighed; but by Measure he finds it contains 64 square Feet $\frac{3}{10}$, and that it was $\frac{3}{8}$ of an Inch precisely in thickness. Lead was then wrought at 211. per Fodder.—Let the Accomptant, from these Items, make out the poor Man's Bill, considering farther, that $4\frac{4}{11}$ oz. is the Weight of a Cubic Inch of Lead?

69. MENSURATION of SOLIDS.

PROBLEM XIII.

To find the Solidity of a Cube, Prism, or Right Cylinder.



RULE.

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Multiply the Area of the Base into the Height or Altitude, and the Product will be the Solidity.

EXAMPLES.

- 1. What is the folid Content of a Cube, whose Side is 2½ Feet?
- 2. How many Ale Gallons of Water will a Cistern hold, whose Length, Breadth, and Depth, are 4 Feet 9 Inches, 3 Feet 6 Inches, and 2 Feet 10 Inches?
- 3. What is the Content of a Cylinder, whose Diameter is $4\frac{1}{2}$ Feet, and 8 Feet high?

PROBLEM XIV.

To find the convex Surface of a Prifm, or a right Cylinder.

A GENERAL RULE.

Find the Area of each Side and End separately, then Add those Areas together, and their Sum will be the whole Surface of any Prism or Body whatever.

A PARTICULAR RULE.

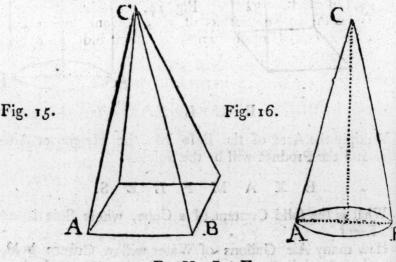
Multiply the Circumference of the Base by the Altitude of the Cylinder, and the Product will give the convex Surface.

E X A M P L E.

4. What is the convex Surface of a right Cylinder, whose Circumference is 10½ Feet, and Height 7¾ Feet.

PROBLEM XV.

To find the Solidity of a Pyramid, or right Cone.



RULE.

Multiply the Area of the Base by a third Part of the Altitude, and the Product will be the Content required.

EXAMPLES.

- 5. Required the Solidity of a square Pyramid, each Side of whose Base is 12 Feet, and the slant Height 25 Feet?
- 6. What is the folid Content of a triangular Pyramid, whose Height is 30 Feet, and each Side of its Base 5 ?
- 7. What is the Solidity of a Cone, whose Base is $3\frac{1}{2}$ Feet Diameter, and Altitude 6 Feet?

PROBLEM XVI.

To find the convex Surface of a Pyramid, or Cone, (as Fig. 15. and 16.)

RULE.

Multiply the Perimeter or Circumference of the Base by the slant Height or Length of the Side (AC) and Half the Product will be the Area.

EXAMPLES

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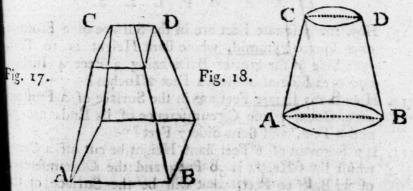
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- 8. What is the Surface of a triangular Pyramid, including the Base, the slant Height being 20 Feet, and each Side of the Base 3\frac{1}{4}?
- 9. What is the convex Surface of a right Cone, whose Base is 45 Feet in Circumference, and slant Side is 20 Feet in Length?

PROBLEM XVII.

To find the Solidity of a Frustum of a Pyramid or Cone.



Add into one Sum the Areas of the two Ends, and the lean Proportional between them; multiply the Sum by the perpen-

perpendicular Height, and $\frac{1}{3}$ of the Product will be the Solidity; that is, if A be the Area of the greater End, and a of the leffer, and b the Height.

Then $A+a+\sqrt{Aa}\times \frac{1}{3}b=$ the Solidity.

EXAMPLES.

10. How many folid Feet are there in a Tree, whose Bases are Squares, each Side of the one being 15 Inches, and each Side of the other 6, and the Length Measures along the Side 24 Feet?

Feet high, the Diameter of its Ends being 20 and 3

Feet ?

per pen.

ta. How many folid Feet are there in a Conical Frustum, the Circumferences of whose Bases are 66 and 56 Feet, Height is 4 Feet?

PROBLEM XVIII.

To find the convex Surface of the Frustum of a Pyramid or right Cone.

R U L E.

Multiply the Sum of the Perimeters or Circumference of the Ends, by the flant Height, and Half the Product will be the Surface required.

EXAMPLES.

13. How many square Feet are in the Surface of a Frustum or a square Pyramid, whose slant Height is 10 Feet, each Side of the greater Bases being 3 Feet 4 Inches, and each Side of the less 2 Feet 2 Inches?

14. How many square Feet are in the Surface of a Frustum of a Cone, whose Circumference of its Ends are 32

and 8 Feet, and flant Side 7 Feet?

whose slant Height is 30 Feet, and the Circumference of its Base 10 Feet, what will be the Surface of the Frustum?

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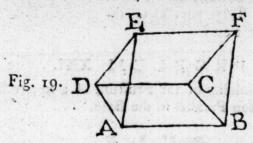
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PROBLEM XIX

To find the Solidity of a Cuneus or Wedge.



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RULE.

Multiply the Area of the Base, ADE, or BCF, by Half the Altitude, D C, of the Wedge, and the Product will give the Solidity.

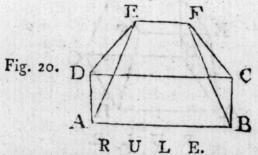
Thus, $AD \times DE \times \frac{CD}{2}$ = the Solidity.

EXAMPLE.

16. What is the Solidity of a Wedge, whose Base measures 30 Feet by 16, and whose Height is 12?

PROBLEM

To find the Solidity of a Pavilion Roof.



To the Length of the Ridge, add twice the Side of the Base, which is parallel to it: Multiply the Sum by the other Side of the Base, and the Product which arises by a fixth Part of the Altitude, and the fecond Product will give the Solidity.

EXAMPLE.

17. What is the Solidity of a Pavilion Roof, whose Base is 36 by 20, Ridge parallel to the greatest Side 16, and Altitude 12 Feet?

PROBLEM XXI.

To find the Solidity of the Frustum of a square Pyramid, made by a Section Parallel to the Base.

RULE.

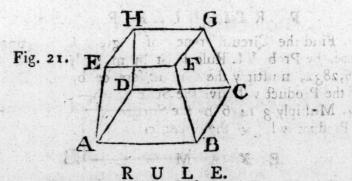
To the Areas of the Ends add the Product of their Sides, multiply the Sum by a third Part of the Altitude, and the Product will give the Solidity.

E X A M P L E.

18. What is the Solidity of the Frustum of a Pyramid 60 Feet high, whose Ends are 16 and 13 Feet square?

PROBLEM XXII.

To find the Solidity of a Prifmoid.



To the Area of the Ends, add the Product of the Sum of the Lengths and Breadths; multiply this Sum by a fixt Part of the Altitude, and the Product will give the Solidiy.

Thus, AB×BC+EF×FG+AB+EF×BC+FG+alt.

EXAMPLE

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19. What is the folid Content of a Canal 304 Feet by 20 at Top, 300 Feet by 16 at Bottom, and 5 Feet deep?

PROBLEM XXIII.

To find the Surface of a Sphere or Globe, or of any Segment or Zone of it.



A GENERAL RULE.

Multiply the Circumference of the Sphere into the Diameter or Height of the Part required, and the Product will be the curve Surface, whether it be Segment, Zone, Hemisphere, or the whole Sphere.

Note.—The Height of the whole Sphere is its Diameter.

PARTICULAR RULES.

1. Find the Circumference of a great Circle upon the Globe, by Prob. VI. Rule I. or by multiplying the Radius by 6,2832, multiply the Circumference by the Diameter, and the Product will give the Superficies.—Or,

2. Multiply 3,1416 by the Square of the Diameter, and he Product will give the Superficies.

EXAMPLES.

- 20. What is the Surface of a Globe, whose Diameter is 7?
- is 6 Inches?
- 2. If the Diameter or Axis of the Earth be 7957 Miles, what is the whole Surface, supposing it a perfect Sphere?
- 3. What is the Superficies of a Segment 9 Feet high, cut from a Globe of 42 Feet Diameter

PROBLEM XXIV.

To find the Solidity or Content of a Sphere or Globe, (See Fig. to Prob. XXIII.)

RULES.

1. Find the Superficies by the last Problem, multiply the Superficies by $\frac{1}{3}$ of the Radius, or by $\frac{1}{6}$ of the Diameter, and the Product will be the Solidity.—Or,

2. Multiply the Cube of the Diameter by ,5236, and

the Product will give the Solidity; that is,

$$\frac{3,1416}{6}$$
 = ,5236, the Solidity.—Or,

3. Find the Content of a circumscribing Cylinder, by Problem XIII. and take $\frac{2}{3}$ of it for the Content of the Globe.

For a Globe is $\frac{2}{3}$ of its circumscribing Cylinder, and 5236 is the Content of a Globe whose Diameter is 1.

EXAMPLES.

24. What is the Content of a Globe whose Diameter is 7?
25. Suppose the Earth to be spherical, and its Diameter 7957 Miles, what is its Solidity?

PROBLEM XXV.

To find the Solidity of the Segment of a Globe. (See Fig. 23.)

RULES.

r. From three Times the Diameter of the Globe, take twice the Altitude of Segment; multiply together the Remainder, the Square of the Altitude, and 0,5236, and this Product will give the Solidity.

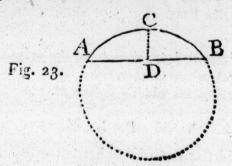
Thus, let b=CD the Height of the Segment, and ds the Diameter.

Then, 3d-2bx,5236×bb= the Solidity of ACB.

2. To three Times the Square of the Radius of its Base, add the Square of its Height; multiply the Sum by the Height, and that Product again by ,5236, will give the Solidity.

That

That is, if r=AD, the Radius of its Base, b=CD, the Height. Then $5236b \times 3rr \times bb =$ the Solidity of the Segment ABC.

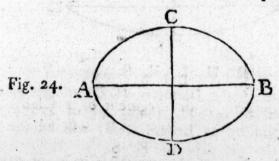


EXAMPLE.

26. What is the Solidity of a Segment 4 Feet high, cut from a Globe 18 Feet Diameter?

PROBLEM XXVI.

To find the folid Content of a Spheroid.



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RULE I.

Multiply continually together the fixed Axis, the Square of the revolving Axis, and the Number ,5236, (being $\frac{1}{6}$ of 3,14159 nearly) and the last Product will be the Content required; that is, if p=314159, &c. t= the Transverse, and c= the conjugate Axis of the generating Ellipse.

Then $\frac{1}{6}pttc =$ the oblate, And $\frac{1}{6}ptcc =$ the oblong Spheroid.

RULE II.

Multiply the Area of the generating Ellipse by $\frac{2}{3}$ of the revolving Axis, and the Product will be the Content of the Spheroid.

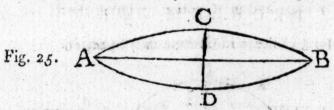
Let A= the Area of the Ellipse, then from the former Rule, $\frac{2}{3}t$ A= the Oblate, And $\frac{2}{3}c$ A= the oblong Spheroid.

EXAMPLE.

27. What is the folid Content of a Spheroid, whose Diameter of the greatest Circle is 33 Inches, and the Length 55 Inches?

PROBLEM XXVII.

To find the Solidity of a Parabolic Spindle.



RULES.

1. The Square of the Diameter (CD) of the greatest Circle, multiplied by ,41888, (being $\frac{8}{15}$ of ,7854) and that Product again by its Length (AB) will be the Solidity.

2. Multiply the Area of the greatest Circle, or middle Section, by the Length, and 15 of the Product will be the

Content.

That is, if AB= the Length or Axis DE= the greatest Diameter, or double the Abscissa of the generating Parabola ACB, and n=,785398, or,7854. Then snxDC² XAB= the whole Solid. ADBCA.

EXAMPLE.

28. What is the Solidity of a Parabolic Spindle, whose greatest Diameter is 36, and its Length 99 Inches?

PROBLEM

PROBLEM XXVIII.

To measure TIMBER.

A square Piece of Timber, equally thick at both Ends, is a Prism; a round Piece, equally thick at both Ends, is a Cylinder; a square Piece, that tapers regularly, is the Frustum of a Pyramid; and a round Piece, that tapers regularly, is the Frustum of a Cone: and the Contents of these Solids may be exactly computed by their respective Rules.

But because the Mensuration of tapering Timber by the exact Rules is troublesome, an Approximation has taken Place, and the Contents of such Trees are generally computed by the following

RULE.

Multiply the Square of the Quarter Girt (or $\frac{1}{4}$ of the Circumference) in Inches, by the Length in Feet, divide the Product by 144, and the Quotient will be the Content in Feet.

But to find the Content more near the Truth, observe the following

RULE.

Multiply the Square of $\frac{1}{5}$ of the Girt or Circumference by twice the Length, and the Product will be the Content, extremely near the Truth.

REMARKS.

- 1. The Girt of a Piece of Timber is its Compass or Circumference at the Middle, ‡ of which is commonly taken for the Side of a Square, equal to the Area of the Section there.
- 2. Trees of regular Growth must be measured in Parts or Pieces, as above directed.
- 3. Allowance must be made for the Thickness of Bark (if on the Tree) in Oak 10 or 12, in other Wood not so much.
- 4. When the Timber is to be reduced to Loads,

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Divide the Feet in { rough hewn, } by { 40 } gives the Load.

As 40 Feet make one Load of rough Timber, and 50 one of hewn.

EXAMPLES.

EXAMPLES.

29. What is the Content of a Tree, whose Girt is 42 Inches, and Length 16 Feet?

30. What is the Content of a Tree, whose Compass is 64

Inches, and the Length 301 Feet?

3t. How many Loads of Timber are there in a hewn Tree, whose Breadth is 42 Inches, Depth 30 Inches, and Length 40 Feet?

GAUGING.

PROBLEM XXIX.

To find the Area of any Triangular, Tun, Back, Cooler, or circular and elliptical Superficies in Ale Gallons, &c.

RULES.

1. Find the Area in Inches by the different Problems in Sect. 75, and the Solidity by Sect. 76, then,

Divide by
$${282 \choose 231}$$
 for ${Ale. Wine. \choose Corn.}$

and the Quotient will be the Area in Gallons .- Or,

2. If the Square of the Diameter of any Circle.

Divide by
$${359.05 \atop 294.12 \atop 342.24}$$
 for ${Ale Gallon. \atop Wine Gallon. \atop Corn Gallon.}$

the Quotient will be the Area in their respective Gallons.

For as ,785398: 1:: 282, the Square of the Diameter of the Circle, whose Area is 282 cubic Inches, viz. one Ale Gallon, and from this Proportion arises the preceding Divisions:

Viz.
$${282 \atop 231 \atop 268.8} \div ,785398 = {359.05. \atop 294.12. \atop 342.24.}$$

Or, these Divisors may be turned into Multiplicators, by dividing Unity or 1, or rather, by dividing the Area in Inches of that Circle, whose Diameter is 1.

That is,
$$,785398$$
, by 282 , &c.
Thus, $,785398 \div \begin{cases} 282 = ,002785 \end{cases}$.
 $231 = ,003399$.
 $268.8 = ,002922$.

The Product will be the Area in Gallons of the same Name.

EXAMPLES.

32. Suppose the Length of a Brewer's Tun, Back or Cooler, be 16 Feet 6 Inches, and its Breadth 7 Feet 4 Inches, what will be the Area in Ale or Beer Gallons, &c.?

33. The Length of the Base of a Triangular Cooler is 94 Inches, and its perpendicular Breadth is 58 Feet 6 Inches: Required its Area in Ale Gallons?

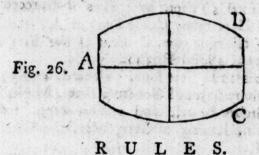
34. Suppose the longest Diameter of a Brewer's Vessel be 84.5 Inches, and the shortest Diameter to be 50 Inches, what will be the Area in Ale Gallons?

35. Suppose a Tun in the Form of the Frustum of a Pyramid, whose Bases are equilateral Triangles, let the Side of the Top be 64 Inches, the Side of the Bottom be 98.6 Inches, and its Height or Depth 36 Inches, what is the Content of that Tun in Ale Gallons, &c.?

36. If the Diameter of the Base of a regular Cone is 60.5 Inches, and the perpendicular Height is 42.8 Inches, what will be the Content in Ale Gallons, &c.?

37. Suppose the Diameter of a Frustum of a Cone be 84 Inches at the Top, and the Diameter at the Bottom to be 62 Inches, and the Height 42 Inches, required the Content in Ale Gallons?

The Bung Diameter EF, Head Diameter CD, and Length of the Cask AB (within Side) being given; to find the Content of a Cylinder nearly equal to it.



the Area of the Circle of the Head, multiply the Sum by one-

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one-third of the Length of the Cask, the Product is the Content in Cubic Inches, which are converted into Gallons: by dividing by 282 for Ale, and 221 for Wine Gallons.—Or,

2. To the Square of the Head Diameter, add twice that of the Bung Diameter, and from that Sum take $\frac{2}{5}$ of the Square of the Difference of the faid Diameters; then multiply the Remainder by the Length of the Cask; then if the Product be multiplied

by $\{0.00092837 = 0.002785 \} \div 3$, will give the Area.

Or divided \[\begin{align*} \frac{1077,15=359.05}{882,36=294.12} \rightarrow \text{3, will give the Area.} \]

EXAMPLES.

38. What is the Content of a Cask, whose Bung Diameter, Head Diameter, and Length is 32, 26, and 40 Inches, within Side respectively?

39. Suppose the Bung Diameter of a Cask to be 40 Inches, Head 36, and Length 64, required the Content both

in Ale and Wine Gallons?

QUESTIONS for Exercise in Mensuration of Solids.

1. What is the Difference between a folid half Foot, and half a Foot folid?

2. What is the Proportion, in Space, between a Room 25 Feet 6 Inches long, 20 Feet 2 Inches broad, 14 Feet high, and two others of just half the Dimensions?

3. Another Room is 17 Feet 7 Inches long within, 13 Feet 10 Inches broad, and $9\frac{1}{2}$ Feet high; it has a Chimney carried up straight in the Angle, the Plan whereof is just the Half of $5\frac{1}{2}$ Feet, by 4 Feet 2 Inches: The Question is, How many Cubic Feet of Air the same will contain, allowing the Content of the Fire Place and Windows at 4 solid Yards?

4. A Ship's Hold is 112½ Feet long, 32 broad, and 5½ Feet deep; how many Bales of Goods, 3 Feet 4 Inches long, 2 Feet 2 Inches broad, and 3 Feet deep, may be flowed therein, leaving a Gang-Way, the Whole 4½

Feet broad?

5. I want a rectangular Cistern, that is 16lb. to the Foot square, shall weigh just a Fodder of Lead; it must be 8 Feet long, and 44 over; how many Hogsheads.

Wine

Wine Measure, will this Cistern contain, taking it at & of an Inch from the Top?

6. A Log of Timber is $18\frac{1}{2}$ Feet long, 18 Inches broad, and 14 Inches thick, die square all through; now if 2 solid Feet and half be sawed off the End, how long will the Piece then be?

7. The folid Content of a square Stone is found to be 126. Feet, its Length is $8\frac{1}{3}$ Feet: What is the Area of one End, and what the Depth, if the Breadth assigned be

381 Inches?

8. The Dimensions of the eircular Winchester Bushel are 18½ Inches over, and 8 Inches deep: How many Quarters of Grain will a square Bin hold that Measures 7 Feet 10 Inches long, 3 Feet 10 broad, and 4 Feet 2 Inches deep within?

o. Taking the Dimensions of the Bushel as above, what must the Diameter of a circular Measure be, which at 12 Inches deep will hold of Bushels of Sea Coal struck?

10. A Prism of two equal Bases, and six equal Sides, that measures 28 Inches across the Center, from Corner to Corner; the superficial and the solid Content is required, taking the Length at 134 Inches?

and am to cut off three Cubic Feet from one End;

whereabouts must the Section be made?

12. I would have a Syringe, 14 Inch in the Bore, to hold a Pint (Wine Measure) of any Fluid; what must the Length of the Piston, sufficient to make an Injection with it, be?

13. I would have a Cubic Bin made capable of receiving just 13 Quarters of Wheat, Winchester Measure; what

will be the Length of one of its Sides?"

14. A Bath Stone, 20 Inches long, 15 over, and 8 deep, weighs 220 lb, how many Cubic Feet thereof will

freight a Ship 290 Tons?

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15. The common Way of measuring Timber being to girt a round strait Tree in the Middle, and to take \(\frac{1}{4}\) of the Girt for the Side of a Square, equal to the Area of the Section there; if this be not considered in the Price appointed, pray on which Side lies the Advantage?

16. The folid Content of a Globe 20 Inches in Diameter, a Cylinder of the fame Diameter, 20 Inches long, and

a Cone

a Cone 20 Inches Diameter at the Base, and 20 Inches high, are severally required; and also what they will

cost painting, at 8d. per Yard?

Miles: I require how many Quarters of Wheat the would contain, if hollow, 2150²/₅ folid Inches being the Bushel; and how much yard-wide Stuff would make her a Waistcoat, was she to be cloathed?

18. Suppose the Atmosphere, or Body of the Air, and Vapours surrounding the Globe of the Earth and Sea to be 60 Miles above the Surface, and the Earth is 7970 Miles in Diameter; how many Cubic Yards of Air then hang about, and revolve along with this Planet?

Inches a piece, and is 20 Feet high by the Slope in the Middle of each Side of the Base, is to be fold at 75. per solid Foot; and if the polishing the Surface of the Sides will be 8d. per Foot more, I would know the Cost of this Stone when finished?

20. A round Mash-Vat measures at the Top 72 Inches over within, at the Bottom 54, the perpendicular Depth being 42 Inches, the Content in Ale Gallons is required?

the Top, is about 8 of the Bottom Diameters in Height, $\frac{1}{3}$ whereof is truly cylindrical, and the other $\frac{2}{3}$ fwelling, but we will suppose it tapers strait, and that it is $\frac{1}{6}$ less at the Top than at Bottom; the Price of the Stone and Workmanship is sought, at 3s. 6d. per Cubic Poot, and farther the superficial Content, including both Ends?

greater End is 19½ Inches, at the less 13½ Inches, the Length 16 Feet 6 Inches; the Value, at 25. 6d. per

Foot folid, is demanded?

23. What Quantity of Brandy will the Distiller's Tun contain, that measures 40 Inches within at the Head, 52 at the Bung, and 100 Inches long; and how many Barrels of London Ale would fill it?

24. Suppose the Globe or Ball, on the Top of St. Paul's Church, to be 6 Feet in Diameter; what did the gilding thereof come to, at 3½d. per Inch square?

25. The famous Tun of Heidelburgh, that being heretofore annually replenished with Rhenish, had in it some Wine

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that was many Ages old, before the French demolished it in the late War; it was 31 Feet in Length, and 21 in Diameter, and pretty nearly cylindrical: Pray how many Tuns of Wine would the same contain?

70. SPECIFIC GRAVITY of METALS.

The specific Gravity of a Body, is the Relation that the Weight of a Body of one Kind hath to the Weight of an equal Magnitude of a Body of another Kind; the Knowledge of which is of great Use in computing the Weights of such Bodies as are too unweildy to have their Weight discovered by other Means.

The following TABLE shews the specific Gravity to Rain Water, of Metals, and other Bodies; and the Weight of a Cubic Inch of each, in Parts of a Pound Avoirdupoise, and of Ounces Troy, and Parts of an Ounce.

BODIES.	Sp. Grav.	wt. lb. Avoir.	wt. oz. Troy.
Fine Gold	19,640	0,7103587	10,459273
Standard Gold	9.520	0,7060185	9.902625
Coall Gold	18,888	0,6828703	9.911707
Quick Silver	13,762	0,4976574	7.384411
Lead	11,313	0,4091696	5.984010
Fine Silver	11,091	0,4011501	5,850035
Standard Silver	10,629	0,3844400	5.556769
Cast Silver	10,528	0,3007870	5,503967
Copper	8,769	0,3171658	4.747121
Plate Brass	8,350	0,2942593	4-404273
Cast Brass	8,104	0,2929832	4,272409
Steel	7,850	0,2839265	4,142127
Bar Iron	7,704	0,2808159	4.031361
Block Tin	7,238	0.2417001	3,861519
Cast Iron	7.135	0,2580647	3,806,568
Load Stone	5,106	0,1846788	2,724083
Blue Slate	3.500	0,1264914	1,867272
Veined Marble	2,702	0,0977286	1,420411
Common Glais	2,600	0.0940393	1,360841
Flint Stone	2.582	0,0983383	1.331419
Portland Stone	2.570	0,0929543	1.345139
Free Stone	2,352	0,0915783	1,231038
Brick	2,000	0,0723379	1,046801
	Aa		RODIES

200 op	ecijic Grav	nly of metals	
BODIES.	Sp. Grav.	wt. lb. Avoir.	wt. oz. Trey.
Alabaster	1,888	0,0683061	0,988456
Ivory Horn	1,832	0,0662606	0,958489
Brimstone	1,800	0,0651042	1,949424
Clay	1,712	0,0619213	0,902498
Lignum Vitæ	1,327	0,0479862	0,699986
Coal	1,255	0,0553921	0,661959
Pitch	1,150	0,0415943	0,606759
Mahogany Wood	1,063	0,0384475	0,560691
Dry Box Wood	1,030	0,0372530	0,543282
Milk			
Sea-Water J	1,033	0,0372530	0,543742
Rain-Water	1,000	0,0361690	0,327458
Red Wine	0,993	0,0359158	0,523766
Bees Wax	9,995	0,0359881	0,524820
Linfeed Oil	0,932	0,0337095	0,491591
Proof Spirits } or Brandy	0,927	0,0335503	0,489268
Dry Oak	0,915	0,0330946	0,489008
Olive Oil	0,913	0,0330222	0,481569
Beech	0,854	0,0308883	0,450449
Dry Elm 7	0,800		
Dry Ash		0,0289352	0,421966
Dry Wainscot	0,747	0,0270182	0,394011
Dry Yellow Fir	0,657	0,0237630	0,346539
Cedar	0,613	0,0221715	0,323332
Dry White Deal	0,569	0,0205801	0,300123
Cork	0,240	0,0186805	0,126590
Air	0,0012	1 0,0000434	0,000633

CASE I.

The linear Dimensions, or Solidity of any Body being given, to find its Weight.

RULE.

Multiply the Cubic Inches contained in that Body by the Tabular Weight corresponding, will give the Weight, in Pounds Avoirdupoise, or Ounces Troy.

EXAMPLES.

- 1. What is the Weight of a Piece of Oak, of a rectangular Form, whose Solidity is 12096 Cubic Inches?
- 2. What is the Weight of a Piece of Fir, whose Girt is 20 Inches, and Length 40 Feet?
- 3. What is the Weight of an Iron Shot, of 7 Inches Diameter?
- 4. What is the Weight of an Iron Shot, weighing 42 lb. Avoirdupoife?

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- 3. What is the Weight of an Iron Bomb Shell, of 3 Inches thick, the greatest Diameter being 16 Inches?
- 6. Required the Weight of one of the Portland Key Stones, to the middle Arch of Westminster-Bridge, the Diameter of the Arch being 76 Feet, the Height of the Key Stone 5 Feet, the Chord of its greatest Breadth, to the Front of the Arch, 3 Feet 4 Inches, and its Depth of the Arch 4 Feet?
- 7. In the Walls of Balbec, in Turkey, there are three Stones laid End to End, now in Sight, that measure in Length 61 Yards; one of which in particular is 63 Feet long. 12 Feet thick, and \(\frac{1}{4}\) Yards over: Now if this Block was Marble, what Power would balance it, fo as to prepare it for moving?

CASE II.

The Weight of any Body being given, to find the Solidity and the specific Gravity thereof.

RULE.

Divide the given Weight by the Tabular Weight corresponding to the Name of the same Kind, and the Quotient will be the Solidity in cubic Inches.

EXAMPLES.

- 8. What will a Block of Marble, weighing 8 Tons, 14 cwt. come to, at 6s. per Foot folid?
- 9. Suppose that a Man of War, with all its Ordnance, Rigging, and Appointment, draws so much Water as to displace 1300 Tuns of Sea Water, London Beer meafure: The Weight of the Vessel is required?
 - A a 2 What

that will a chain of standard Gold weigh in Water that raises a Fluid an Inch, in a Vessel three Inches square, when put into it; and supposing the Workman had adulterated the said Chain with 14½ Ounces of Silver, how much higher would the Water, upon its Im-

mersion, be railed in the Vessel?

11. Hiero, King of Sicily, ordered his Jeweller to make him a Crown, containing 63 Ounces of Gold; the Workmen thought of fubfituting part Silver therein, to have a proper Perquifite, which taking Air, Archimedes was appointed to examine it, who, on putting it into a Vessel of Water, found it raised the Fluid, or that itself contained 8,2245 Cubic Inches of Metal, and having discovered that the Cubic Inch of Gold more critically weighed 10.36 Ounces, and that of Silver but 5,85 Ounces, he, by Calculation, found what Part of his Majesty's Gold had been changed, and you are defired to repeat the Process?

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TUTOR'S GUIDE.

PART V.

71. CHRONOLOGY

I S the Art of estimating and comparing together the Times when any memorable Transaction hath happened, such as related in History, whether civil or ecclesiastical.

It also takes a View of the various Facts, Calendars, and Methods of computing Time, practifed by different Nations, compares them together, and fettles such Order and Harmony among them, that the exact Time in which any remarkable Event happened may be certainly known.

Years Years of the before World. Christ. Some have dated their Events from the 0000 4004 Creation of the World Others from the Deluge or Flood 1656 2348 The Greeks from their Olympiads of 4 3228 776 Years each The Romans from he Building of Rome 3251 753 The Astronomers from Nabonassar King 5257 747 of Babylon Some Historians from the Death of Alex-328 3676 ander the Great We From the Birth of Christ A. D. The Mahomitans from the Flight of Ma-4626 homet, and called the Hegira Aa a PROBLEM

PROBLEM I.

To find whether any given Year be Leap Year.

RULE.

Divide the given Year by 4, if o remains, it is Leap Year, but if 1, 2, 3, remains, it is so many Years after.

EXAMPLES.

- 1. Is 1779 Leap Year?
- 2. Is 1780 Leap Year?
- Note 1.—Every fourth Year is Leap Year, so called from leaping or advancing a Day more that Year than any other; that Year has then 366 Days in it, and February 29.

PROBLEM II.

To find the Dominical Letter till the Year 1800.

RULE.

To the given Year, add its fourth Part, omitting Fractions, divide that Sum by 7, the Remainder taken from 7, leaves the Index of the Letter in the common Year's Reckoning.

1 2 3 4 5 6 7 A B C D E F G

But in Leap Years, this Letter and its preceding one (in the retrograde Order which these Letters take) are the Dominical Letters.

SER DE E X A M P L E S.

- 3. For the Year 1786, I demand the Dominical Letter?
- 4. For the Year 1788, I demand the Dominical Letter?
 - 2. The Dominical Letter, is that Letter of the Alphabet which points out in the Calendar the Sundays throughout the Year; thence also called the Sunday Letter: Of these Letters are consequently seven before mentioned, beginning with the first Letter of the Alphabet; and, as in Leap Year there is an intercalary Day, there are then two, one serving January and February, and its following Letter the remaining Part of the Year.

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PROBLEM III.

To know on what day in the Week any proposed Day of the Month will fall.

R U L E.

First find the Dominical Letter, then the Day of the Week the first of the proposed Months fall on, which is known by the two following Lines:

> At Dover dwell George Brown, Esquire, Good Christopher Finch, and David Frier.

Where the first Letter of each Word answers to the Letter belonging to the first Day of the Months in order, from January to December.

3. You must observe that the 1st, 8th, 15th, 22d, and 29th Day of any Month falls on the fame Day of the Week.

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5. In 1786, on what Day of the Week does the 19th of May fall, it being Queen Charlotte's Birth-Day?

6. On what Day of the Week does the 4th of June fall in 1788, being King George the Third's Birth-Day?

PROBLEM

To find the Year of the Solar, Lunar, or Golden Number, and Indiction Cycles.

RULE.

To the given Year add 9 for the Solar, I for the Lunar, g for the Indiction, divide the Sums in order by 28, 19, and 15, the Remainder in each shews the Year of its respective Cycle.

EXAMPLE

7. Required the Year of the Solar, Lunar, and Indiction, Cycles, for the Years 1786 and 1788?

4. The Solar Cycle, or the Cycle of the Sun, is a Period of 28 Years; in which Time all the Varieties of

the Dominical Letters will have happened, and the 29th Year the Cycle begins again, when the fame Order of the Letters will return as were 28 Years before.

At the Birth of Christ, nine Years had passed in this Cycle. The Lunar Cycle, or Cycle of the Moon, or Golden Number, is a Period of 19 Years, containing all the Variations of the Days on which the new and full Moons happen, after which Time they fall on the same Days they did 19 Years before, and she begins again with the Sun.

But when a Centiffimal or Hundredth Year falls in the Cycle, the new and full Moon, according to the new Stile, will fall a Day later than otherwife. The birth of Christ happened in the second Year of this Cycle.

The Roman Indiction is a Cycle of 15 Years, which first

began the third Year before Christ.

PROBLEM V.

To find the Epact till the Year 1900.

RULE.

Multiply the Golden Number for the given Year by 11, divide that Product by 30, and from the Remainder take 11, leaves the Epact. If the Remainder is less than 11, add 19 to it, and the Sum will be the Epact.

EXAMPLES.

8. Find the Epact for the Year 1788.

9. Required the Epact for the Year 1786?

5. The Epact of any Year is the Moon's Age, at the Beginning of that Year, that is, the Days past fince the last new Moon.

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PROBLEM VI.

To find the Moon's Age.

RULE.

To the Epact, add the Number and Day of the Month, their Sum, if under 30, is the Moon's Age. But if that Sum

Sum is above 30, the Excess in Months of 31 Days, or the Excess above 29, in a Month of 30 Days, thews the Age, or Day fince the last Conjunction.

The Moon's Age taken from 30, leaves the Day of the

next new Moon.

of Bulan Table

When the Solar and Lunar Cycles begin together, the Moon's Age on the first of each Month, or the Monthly Epacts, are called the Numbers of the Month, and are as follows, viz.

For Jan. Feb. Mar. April. May. Thefe 0. 2. I. 2. July. Aug. Sep. Oct. Nov. Decem. Thefe 6. 8. 7. 9. 5.

EXAMPLES.

10. Required the Moon's Age on May 21, 1788?

11. What is the Moon's Age on the 24th of March, 1786?

6. The Moon's Age is how many Days are past since the Day of her Change, which Age never exceeds 30 Days.

PROBLEM VII.

To find when Easter-Day will happen.

RULE.

Find on what Day of March the new Moon falls nearest to the 21st in common Years, or nearest the 20th in Leap Years, then the Sunday next after the full, or 15th Day of that new Moon, will be Easter-Day.

If the 15th Day falls on a Sunday, the next Sunday is

Easter-Day.

EXAMPLES.

12. On what Day does Easter-Sunday fall for the Year 1788?

13. Required the Time of Easter-Day for the Year 1786?

7. Easter

7. Easter is the Time when Christians celebrated the Refurrection of Christ from the Grave, and took its Rise from Eastra, the name of the Sexon Deity or Goddess, whose Festival was celebrated about this Time of the Year, and after its Abolishment by Christianity, the Name was retained, and is to this Day used to signify the Festival of Christ's Resurrection, as mentioned above.

PROBLEM VIII.

To find the Time of the Moon's Southing.

RULE.

Multiply the Moon's Age by 4, divide the Product by 5, quotes the Hours, and the Remainder, multiplied by 12,

gives the additional Minutes.

If this Time is less than 12 Hours, it is the Time of Southing after Mid-Day; but if greater, 12 Hours taken from it, leaves the Southing after Midnight.

EXAMPLES.

14. Required the Time of the Moon's Southing at London, on the 21st of May, 1788?

15. At what Time does the Moon come to the Meridian at Bristol Key, on March 24, 1786?

8. The Moon's Southing at any Place, is the Time when the comes to the Meridian, or is full South of that Place, which is every Day later, by about 48 Minutes, occasioned by the Hours in a Day being divided by the 30 Times the passes the Meridian from new Moon to new Moon.

PROBLEM IX.

To find the Time of High Water at any Place.

R U L E.

To the Time of the Moon's Southing, add the Time the Moon has passed the Meridian to make High Water at that Place, and the Sum will shew the Time of High Water.

The

The Distance of the Moon from the Meridian when High Water at the following Places, is, at London, D bears N. E. or S. E. 3h. om. Bristol Key D bears E. by S. and W. by N. 6h. 45 m.

EXAMPLES.

16. On the 21st of May, 1788, at what Time is it High Water at London?

17. On the 24th of March, 1786, at what Time is it High Water at Briftol Key?

10. High Water is the State of the Tide when highest, or the Time it ceases to flow up.

QUESTIONS for Exercise at Leisure Hours.

1. England was conquered by William I. October 4, 1066; his Son, William II. came to the Crown Sept. 9, 1087, and left it August 2, 1100; William III. received it Feb. 3, 1689, and died March 8, 1701: How many Days did each of these Princes govern, respect being had to the intercalary Days, and to February every Leap Year, as they rose in the Course of Time?

2. Richard I. succeeded his Father Henry II. July 7, 1189;
John his Brother succeeds him April 6, 1199; Richard
II. succeeded Edward III. on the 21st of June, 1377,
and was deposed by Henry IV. on the 30th of September, 1399; Richard III. caused his Nephew, Edward
V. and his Brother, to be murdered, on the 18th of
June, 1483, and was slain himself on the 22d of August,
1485: How many Days was the Realm governed by
the three Richards, respect being still had to the intercalary Days as they happened?

3. The first Queen Mary came to the Crown July 8, 1553; she reigned 5 Years, 4 Months, and 9 Days; her Sister Elizabeth succeeded, and James I. came to the Throne the 14th of March, 1602, who left it to his Son, Charles I. on the 27th of March, 1625, who was forced from it January 30, 1648: The Question is, How many Days did these Princes reign, and at the Death of Charles I. how long had England been under

an uninterrupted Succession of Protestant Princes, Mary the First being the last protessed Papist that enjoyed the Crown, not neglecting the intercalary Days in February as before?

4. A Grant was made Feb. 14, in the 10th of Henry I. who began his keign August 2, 1100; it was resumed Nov. 19, in the 4th of Henry III. who came to the Crown October 19, 1215; it was received the 16th Day of July, in the 13th of Henry VII. who atcended the Throne August 22, 1486; but it was a second Time revoked and finally suppressed, in the 16th of his Successor, Henry VIII. on the 10th of May: Now as this Man's Father died July 21, 1509, the Question is, How many Days was this Grant in Force, and how many did it lie dormant?

79. GEOGRAPHY.

Examples on the Terrestrial Globe, or Maps.

1. What is the Latitude and Longitude of Pekin, in China, and Cape Horn?

2. Required the Name of that Place whose Latitude is 18°
N. and Longitude 76½ W. also of another Place, whose Latitude is 34½° S. and Longitude 16½ E.?

3. What is the Difference of Latitude between London and Naples; also between the Island of Barbadoes, and the Cape of Good Hope?

4. Required the Distance (in English Miles) Jamaica is from London; also the Names of all those Places that are at the same Distance from London as Rome is?

5. Required the Sun's Declination, Right Afcension, and Meridian Altitude, on the 20th of May?

6. Required the Time of the Sun's rifing and fetting, on the 20th of May; also his Amplitude at the same Time?

Likewise when the Twilight begins and ends?

7. What is the Sun's Azimuth and Altitude, on the 20th of May, at 4 o'Clock in the Afternoon?

8. What is the Angle of Polition, or Bearing of Port Royal in Jamaica, from London; and on the contrary, London from Port Royal?

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g. When it is Noon, or Twelve o'Clock, at London, what o'Clock is it at Pekin in China; also at what Places are they breakfasting, dining, and supping, suppose they breakfast at 7 o'Clock, dine at 1, and sup at a Quarter after 9?

10. What Places are those to which the Sun is vertical on the 2d of May?

11. On what two Days in the Year will the Sun be vertical to Candy, in the Isle of Ceylon?

which the Sun begins to shine constantly without setting, on the 20th of May?

13. On what Day doth the Sun begin to shine constantly, without setting, at the Cherry Island, whose Lat. is 74° North; and how long?

14. What Places are those to which the Sun is rising, setting, or in the Meridian; also those Places which are enlightened, and those which are not, on the 20th of May, at 8 in the Morning?

at _____ will happen an Eclipse of the Sun; I demand to know to what Part of the Globe the same will be visible?

16. On the 3d of June, 1769, in the Afternoon, happened a Trantit of Venus over the Sun; the Beginning of this Transit was at 7 h. 13 m. Middle 10 h. 35 m. End 1 h. 55 m. I demand to know where the Beginning, Middle, and End thereof, was visible?

17. In what Latitude is the longest Day 20 Hours long?

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18. What Inhabitants of the Earth are those called Antoeci, Perioeci, and Antipodes, with respect to London?

19. What is the Sun's Declination on the 20th of June by the Analemma, without knowing a Place?

20. It is required to find by the Analemma, the Sun's Place in the Ecliptic and right Ascension, on the 12th of May?

21. Required to find by the Analemma, the Time of the Sun's rifing and fetting, with an Amplitude on the 30th of March?

22. What is the Sun's Altitude and Azimuth for the 26th of April, at 10 in the Morning by the Analemma?

23. On the 24th of April in the Morning, in Lat. 51° 30' N. the Sun's Altitude was 26°, required the Hour and Azimuth, by the Analemma?

24. Suppose a Ship sails from a Part A. in Lat. 38°, to another Part B. in Lat. 5° N. and then finds her Difference of Longitude 43°: Required her Course and distance sailed?

25. A Ship fails from a Part A. in Lat. 26° N. to another Part B. in Lat. 20 S. upon a Course of 46°: Required the Difference of Longitude, and Distance failed?

26. Suppose a Ship fails from a Part A. in Lat. 51° 30' to another Part B. in Lat. 18, Distance 2226 Miles, required the Difference of Longitude and Angle of the Courfe?

27. Suppose a Ship fails from a Place A. in Lat. 510, on a Courfe, making an Angle with Meridian of 40°, till the Difference of Longitude be found to be 20: Required the Difference of Latitude, and Distance failed?

28. A Ship from the Latitude 47° 30' N. has failed S. W. by S. 1980 Miles: Required the Difference of Latitude and Longitude?

EXAMPLES on the CELESTIAL GLOBE.

. Required the Time of the Sun's rifing and fetting; also, the Beginning and End of the Crepusculum, or Twilight, on the 21st of June?

2. What is the Moon's diurnal Motion in the Ecliptic? alfo at what Time doth fhe Rife, Set, and come to the

Meridian, on the 20th of May?

3. Required the Latitude of the Moon, and her Declina-

tion, on the 20th of May?

4. At what Time doth the Planet Jupiter Rife, Culminate, and Set, on the 20th of May; also, what its right Ascension, Declination, Amplitude, and Azimuth, on the above Day?

5. What is the Right Ascension, Declination, Latitude,

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and Longitude of Pollux?

6. What Star is that whose right Ascension is 65° 30", and its Declination 12° 15' 30" North; also what Time doth it Rise, come to the Meridian, Set, and what what is its Amplitude on the 20th of July, in the Lat. of London?

7. On what Day of the Year will the Star Arcturus rife and fet Cofmically, at London?

8. Required the Time when Procyon and Canis Minor, will rife and fet acronically at London?

9. On what Day of the Year will Altayr Culminate, or come to the Meridian with the Sun?

10. At what Time of the Year will the Pleiades, or Seven Stars, be upon the Meridian at Midnight?

11. What is the oblique Ascension of Sirius, and what is the Time of its Continuance above the Horizon of London?

12. What is the Altitude and Azimuth of Capella, on the 20th of May, at 10 o'Clock at Night, in the Latitude of London?

13. The Altitude of Cor Leonis, on the 22d of May, at London was 20, required the Hour of the Night?

14. A Person being in a certain Place, on the 20th of May, at \(\frac{1}{4} \) after 3 in the Morning, observed the Pleiades were then rising; required the Latitude of the Place of observation?

15. On the 11th of May, in the Latitude 51°, 30', the two Stars, Luci a Lyræ, and Altyar, will both be on the fame Azimuth: Required the Hour of the Night?

on the 11th of May (Lat. as before) the bright Star marked in Pegasus's Wing, and that in the Head of Andromeda, will both have an equal Altitude; required the Hour?

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17. A Person being at Sea, found, by Observation, that Sirius was then upon the Miridian, and Arcturus rising; required the Lat. of the Place of Observation?

18. Another Person being at a certain Place, sound, by Observation, Cor Hydræ and Procyon are both on the Azimuth of 78° 45′ S. E. one with 5° of Altitude, and the other with 35°: Required the Latitude of the Place of Observation?

19. To what Latitude, South, must I travel, to lose Sight of the Star Capella?

20. Represent the Face of the Heavens on the Globe, on the 20th of May, at 10 at Night?

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21. By an Observation made at Jamaica of a Comet, on the 31st of March, 1759, at 50'Clock in the Morning, its Altitude was found to be 22° 50', and Azimuth 71° South East. Another Observation was made at London on the 6th of May, 1759, at 10 at Night, of the same Comet, and then its Altitude was found to be 16°, and its Azimuth 37° S. W. It is required to know the Place of the Comet at each Observation?

22. Required the Time of the above Comet's rifing, fouthing, and fetting at London, on the 31st of March 1759; also its Latitude, Longitude, Declination, and

Afcension?

23. Required the apparent Path among the fixed Stars in the Heavens, of the above Comet; also its Velocity?

Note.—These Problems are answered by Mr. Hill's Twelve-Inch Globes.

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TUTOR'S GUIDE.

PART V.

73. A L G E B R A.

Acithmetic in Letters; and is that Science which teaches, in a general Manner, the Comparison of abstract Quantities; by Means whereof, such Questions are resolved whose Solutions would be fought in vain from common Arithmetic.

Here every Quantity, whether given or required, is commonly represented by some Letter of the Alphabet; the known or given Quantities, for Distinction Sake, being noted by the first Letters, a, b, c, d, &c. and the unknown Ones by the last Letters, x, y, z, &c.

There are, moreover, in Algebra, certain Signs or Notes, made use of to shew the Relation and Dependence of Quantities one upon another, whose Signification the Learner ought first of all to be made acquainted with. (See the Characters for Abbreviation next before Page 1.)

74. A D D I T I O N

Addition in Algebra, is performed by connecting the Quantities by their proper Signs, and joining in any Sum fuch as can be united.

For performing which observe the following

RULES.

1. If the Quantities to be added are alike, and have the fame Sign, add the Coefficients together, and to their Sum prefix the common Sign, and adjoin the common Letter or Letters.

2. If the Quantities to be added are alike, but have unlike Signs, add together the Coefficients of the affirmative Terms (if there be more than one) and do the fame by the negative ones, and to their Difference prefix the Sign of the greater, adding the common Letter or Letters.

3. If the Quantities to be added are unlike, write them down after the other, with their proper Signs and Coefficients prefixed.

EXAMPLES.

(1) To
$$6a+7b-3c$$
 (2) $ab-6b+4x+10y-15z+6$
Add $10d+b-7c$ $6ab-b+x+4y-9z+3$

(3) To
$$-6b-7c-8x + 4b+9c+5x$$
 (4) $6a-6x+7y-10 -6a+6x-4y+13$

(5) To
$$4a+6b+4c-6$$
 (6) $2a-6bc$
Add $-4x-7y+4z$ $6x+10$

(7) To 10a
$$\sqrt{bc}$$
 (8) $a\sqrt{bb+cc}$ (9) $b+3\sqrt{aa-u}$
Add $6a\sqrt{bcc}$ $4\sqrt{bb+cc}$ $b-3\sqrt{aa-u}$

75. SUBTRACTION.

Subtraction of Algebra is performed by the following general

RULE.

Change the Signs of the Quantity to be fubtracted into their contrary Signs, and then add it, so changed, to the Quantity from which it was to be subtracted (by the Rule of Addition) the Sum arising will be the Remainder.

EXAMPLES.

(1) From
$$3a$$
 (2) $2a-4x+7y-7$ (3) $6b-4c+4x$. $-3a$ (3) $6a+4x+7y+4$ $7b+7c-9x$.

(4) From 10a
$$V$$
 bc (5) $6b\sqrt{aa+xx}$ (6) $b+a$

$$6a \lor bc$$

$$4b\sqrt{aa+xx}$$

$$a-\sqrt{cc-aa}$$

76. MULTIPLICATION.

Multiplication of Algebra is also performed by the following general

RULE.

Multiply the Coefficients (if any) together, as in Sect. 4. and to their Product join the Letters, and prefix the proper Sign before them, which, when the Signs of the Factors are alike, that is, both +, or both —, the Sign of the Product is more; but when the Signs of the Factors are unlike, the Sign of the Product is —.

EXAMPLES.

(1) Mul.
$$a+c$$
 By b (2) $-a-b-c$ (3) $x+y+z$.

(4) Mul. $-8x$ (5) $12x+6y$ (6) $-6d$.

 $+7b$.

(7) Mul.
$$4x-5y+z$$

By $-6f$

$$(8) 2a - 4b$$
 $2a + 4b$

(14) Mul.
$$\sqrt{xx+zz}$$

By $\sqrt{xx-zz}$
Prod.

(15) 6cd
$$\sqrt{b+ad}$$
.
3a \sqrt{ca} .

77. DIVISION.

Division of Algebra Quantities is the direct Contrary to that of Multiplication, and consequently performed by direct contrary Operations.

RULES.

1. When the Quantities in the Dividend have like Signs of those in the Divisor, and no Co-efficient in either, cast off all the Quantities in the Dividend, that are like those in the Divisor, and set down the other Quantities with the Sign + for the Quotient.

2. When the Quantities in the Dividend have unlike Signs to those in the Divisor, then set down the Quotient Quantities found as in the last Rule with the Sign — be-

fore them.

3. If the Quantities in the Divisor cannot be exactly found in the Dividend, then set them both down like a Vulgar Fraction, and find all the Quantities of the same Letters that are in the Dividend and Divisor, and proceed with the Co-efficients, as in Case I. Sect. 36.

4. If

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4. If the Quantity to be divided is compound, range its Parts according to the Dimensions of some one of its Let-

ters, and proceed as in Sect. V.

5. Different Powers or Roots of the same Quantity are divided by fubtracting the Exponent of the Divisor from that of the Dividend, and place the Remainder as an Exponent to the Quantity given.

AMPLES. \mathbf{X}

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(1.)
$$d)ad+6d($$
 (2.) $-d)-ad-bd($ (3.) $a)aa+ab($ (4.) $-a)ab($ (5.) $b)-ab-bd($ (6.) $-bc)abc+bcd+bcf($ (7.) $7b)42db($ (8.) $2bx)8abx-18bxc($ (9.) $2b)ab+bb($ (10.) $20a)10ab+15ac($ (11.) $a-b)aaa-3aab+3abb-bbb($ (12.) $a+b)aa+2ab+bb($ (13. $a+b)aa-bb($ (14.) $3a-6)6a^4-96($ (15.) $3x^2-4x+5)18x^4-45x^3+82x^2-67x+40($ (16.) $4z-5a)48x^376ax^2-64a^2x+105a^3($ (17.) $3x+4a)81x^4-256a^4($ (18.) $2x-3a)16^4x-72a^2x^2+81a^4($ (19.) $2xy\sqrt{z})4xy\sqrt{xzz}($

(20.) 20 V 2cy60ab V 10acxy(

 $(21.) x^2)x^5((22.) a+x)^3)a+x^7($

FRACTION

Reduction of Algebraic Fractions are of the same Nature, and require the same Management as those of Num-

A mixt Quantity is reduced to an improper Fraction by the Rules in Sect. 36, Case 3.

XAMPL E S.

- 1. Reduce $a-x+\frac{a^2-ax}{x}$ to an improper Fraction.
- 2. Reduce $a+b+\frac{x}{x}$ to an improper Fraction.
- 3. Reduce $a-x+\frac{aa-ax}{x}$ to an improper Fraction.

Fractions.

An improper Fraction is reduced to a mixt Quantity, by the Rule in Sect. 36, Cafe IV.

EXAMPLES

4. Reduce
$$\frac{a^2-x^2}{x}$$
 to a mixt Quantity.

g. Reduce
$$\frac{az+bz+x}{z}$$
 to a mixt Quantity.

6. Reduce
$$\frac{ax-xx+aa-ax}{x}$$
 to a mixt Quantity.

Fractions of different Denominations are reduced to Fractions of equal Value, and to have the same Denominator by the Rule in Sect. 38, Case V.

EXAMPLES.

7. Reduce $\frac{a}{b}$, $\frac{c}{d}$, and $\frac{e}{f}$, to a common Denominator.

8. Reduce
$$\frac{b+c}{a+b}$$
 and $\frac{d-c}{b-d}$ into one Denomination.

Fractional Quantities are reduced into their lowest Terms by the Rule in Sect. 38, Case I.

EXAMPLES.

9. Reduce
$$\frac{aaa-abb}{aa+2ab+bb}$$
 to its lowest Terms.

10. Reduce
$$\frac{25az}{5xz+15az}$$
, and $\frac{aaa+bbb}{aa-bb}$, to their lowest Terms.

The Rules for Addition, Subtraction, Multiplication, and Division of Algebraic Fractions, are the same as for Numerical Fractions; see Sect. 36, 37, 38, and 39.

EXAMPLES in ADDITION.

1 Add
$$\frac{a}{b} + \frac{c}{d}$$
 and $\frac{d}{c}$ into one Sum.

- 2. Add $\frac{a-b+d}{d+a}$, and $\frac{a+b-d}{d+a}$ together.
- 3. Add $\frac{2a-b}{d+c}$, and $\frac{2b-a}{a+c}$ together.
- 4. Add $\frac{a+b}{d}$ to $\frac{2a+c}{d}$.

EXAMPLES in SUBTRACTION.

- (1.) From $\frac{x}{2}$ take $\frac{x}{3}$. (2.) From $\frac{a+x}{b}$ take $\frac{a-x}{c}$.
- (3.) From $\frac{bb+aa}{c}$ take $\frac{bb}{c}$. (4.) From $\frac{2b}{a+d}$ take $\frac{a+b-d}{a+d}$.

EXAMPLES in MULTIPLICATION.

- 1. Mul. $\frac{a+b}{c}$ by $\frac{a-b}{d}$. 2. Mul. $a+\frac{b}{c}$ by $\frac{d}{c}$.
- 3. Mul. $\frac{3a-2b}{2d+c}$ by $\frac{4a+2b}{d}$.

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4. Mul. $2a + \frac{b}{c} - 25$ by 36 + 4c.

EXAMPLES in DIVISION.

- 1. Divide $\frac{acd+ba}{cd}$ by $\frac{d}{c}$. 2. Divide $\frac{a-b}{a}$ by $\frac{a+b}{a-b}$.
- 3. Divide $a + \frac{b}{c}$ by $d + \frac{e}{f}$. 4. Divide $\frac{ab}{c}$ by $\frac{1}{c}$.

79. INVOLUTION.

Involution is the raifing of any given Quantity to any proposed Power.

1. If the Quantity proposed to be involved has no Index, that is, if it be not itself a Power or a Surd, the Power thereof will be represented by the same Quantity under the given Index or Exponent.

Thus, the Cube or third Power of x, is expressed by x^3 .

And the fixth Power, a+z, by a+z)⁶, &c.

- 2. But if the Quantity proposed be itself a Power or Surd, it will be involved by multiplying its Exponents by the Exponent of the proposed Power.
- Thus, the fifth Power of x^2 is x^{10} , the fourth Power of $ax+y^3$ is $ax+yy^{12}$, and the third Power of $a-x|_2^2$ is $a-x|_2^3$.
- 3. A Quantity composed of several Factors, multiplied together, is involved by raising each Factor to the Power proposed.
- Thus, the Square or fecond Power of ax is $a^2 x^2$, the Cube or third Power of 2ax is $8a^3 x^3$; the fourth Power of $4 \times \overline{aa} xx \times \overline{a+b+c}$ is $16 \times \overline{aa} 1 \times \overline{a+b+c} + 1 \times \overline{a+b+c} + 1 \times \overline{aa}$ is $a \times \overline{a+x} = 1 \times \overline{aa}$.
- 4. A Fraction is involved by raising both the Numerator and the Denominator to the Power proposed.
- Thus, the Cube or third Power of $\frac{a}{b}$ is $\frac{aaa}{bbb}$, and the fourth

Power of $\frac{2a^2x}{3b^2}$ is $\frac{8a^8x^4}{81b^0}$; likewife the fixth Power of $\frac{aa+xx}{2}$ is $\frac{aa-x}{a-x}$

5. Quantities compounded of feveral Terms, are involved by a continual Multiplication of all their Parts.

Thus $a+b\times a+b=a^2+2ab+2b$.

EXAMPLES.

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EXAMPLES.

- 1. Involve of raise x to the fourth Power.
- 2. Raife ax+22 to the fifth Power.
- 3. Involve 3x3z2 to the third Power.
- 4. Involve $\frac{5ab}{2c}$ to the fixth Power.

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- 5. Involve or raise a+b to the fixth Power, this is called a Binomial Root.
- 6. Involve or raise a—b the fixth Power, this is called a Residual Root.

There is a Rule or Theorem, given by Sir Isaac Newton, whereby any Power of a Binomial, or x-y, may be expressed in simple Terms, without the Trouble of those tedious Multiplications which are required otherwise.

Theo.
$$1 \times \frac{m-0}{1} \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-2}{4} \times \frac{m-4}{5} \times \frac{m-5}{6} \times$$
, &c.

- Note, m is the Exponent of the Power, that is, m=7, in the feventh Power, 6 in the fixth Power, &c.
- So that if x-y is to be raifed to any Power m, the Terms, without their Co-efficients, will be

$$x^{m}, x^{m-1}, x^{m-2^{2}}y, x^{m-3^{3}}y, x^{m-4^{4}}y, x^{m-5^{5}}y, x^{m-6^{5}}y$$

&c. continued till the Exponent of p becomes equal to m.

And the Co-efficients of the respective Terms will be

$$\frac{1, m, m \times \frac{m-1}{2}, m \times \frac{m-1}{2} \times \frac{m-2}{3}, m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4}}{m \times \frac{m-1}{2} \times \frac{m-2}{3} \times \frac{m-3}{4} \times \frac{m-4}{5} \times \frac{m-5}{6} \times \frac{m-6}{xy_0} +, &c.}$$

So by this Theorem any Quantity, confisting of two Terms, is raised to any Power m, with great Ease and Perspicuity, and will be of great Service to the young Algebraist, if properly demonstrated to him by his Tutor.

80. EVOLUTION.

Evolution, or the Extraction of Roots, being directly the contrary to Involution, or raising of Powers, is performed by converse Operations, viz. by the Division of Indices, as Involution was by their Multiplication.

Thus, the Square Root of x^6 , is x^3 , the Cube Root x^0 is x^2 , also the biquadratic Root of $x+y^8$, will be $x-y^2$; and the Cube Root of $xx-yy^2$ will be $xx-yy^2$. Moreover the Square Root of $xx-yy^2$ will be $xx-yy^2$, its Cube Root $xx-yy^3$, and its Biquadratic Root $xx-yy^3$, and so of others.

Evolution of Compound Quantities is performed by the following

RULE.

First, place the several Terms, whereof the given Quantity is composed, in order, according to the Dimensions of some Letter therein, as shall be judged most commodious; then let the Root of the first Term be sound, and placed in the Quotient, which Term being subtracted, let the first Term of the Remainder be brought down, and divided by twice the first Term of the Quotient, or by three Times its Square, or sour Times its Cube, &c. according as the Root to be extracted is a Square, Cubic, or Biquadratic one, &c. and let the Quantity thence arising be also wrote down upon the Quotient; and the Whole be raised to second, third, or sourth, &c. Power, according to the aforesaid Cases respectively, and subtracted from the given Quantity, and if any Thing remains, let the Operation be repeated, by always dividing the first Term of the Remainder by the same Divisor, sound as above.

EXAMPLES.

1. It is required to extract the Square Root of x^2+2xy $+y^2$?

2. It is required to extract the Square Root of $x^2 + y^2$?

3. It is required to extract the Square Root of $x^4 + 2x^3y + 3x^2y^2 - 2xy^3 + y^4$?

4. Extract

4. Extract the Cube Root of $x^3-6x^2y+12xy^2+8y^3$?

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5. Extract the Biquadratic Root of $16x^{4} - 96x^{3}y + 216x^{2}y^{2} - 216xy^{3} + 81y^{4}$?

81. INVOLUTION of SURD QUANTITIES.

1. When the Surds are not joined to radical Quantities, they are involved to the same Height as their Index denotes, by taking away their radical Sign.

Thus, \sqrt{xx} will be x, and $\sqrt{xx+yy}$ will be x^2+y^2 , &c.

2. When Surds are joined to rational Quantities, involve the rational Quantities to the fame Height as the Index of the Surd denotes; then multiply the involved Quantities into the Surd Quantities, after the radical Sign is taken away, as before.

Thus, $x\sqrt{yy}$, will be x^2y^2 , and $4x\sqrt{xx+yy}$, will become $16x^4+16x^2y^2$, likewife, $2x^3\sqrt{x+y^2}$, will become $8x^5+8x^3y^2$, &c.

82. E Q U A T I O N S.

An Equation is, when two equal Quantities, differently expressed, are compared together, by means of the Sign=placed between them.

REDUCTION of SINGLE EQUATIONS.

RULES.

1. Any Term of an Equation may be transposed to the contrary Side, if its Sign be changed.

Thus, x+12=20, then will x=20-12=8.

2. If there is any Quantity by which all the Terms of an Equation are multiplied, let them all be divided by that Quantity, but, if all of them be divided by any Quantity, let the common Divisor be cast away.

Thus, ax=ab, then will $x=\frac{b}{a}$; also, if $\frac{x}{b}=\frac{a}{b}$, x=a, by the latter Part of the Rule.

3. If there are irreducible Fractions, let the whole Equation be multiplied by the Product of all their Denominators nators, or which is the fame, let the Numerator of every Term in the Equation be multiplied by all the Denominators except its own, supposing such Terms (if any there be) that stand without a Denominator, to have an Unit subscribed.

Thus
$$x + \frac{x}{2} + \frac{x}{3} = 11$$
, reduced is $6x + 3x + 2x = 66$, or $x = 66$

- 6. per Rule 5. Again, $\frac{2x}{3} + 12 = \frac{4x}{5} + 6$, this reduced will become 10x + 180 = 12x + 90; then per Rule 1, x = 45.
- 4. If in your Equation there is an irreducible Surd, wherein the unknown Quantity enters, let all the other Terms be transposed to the contrary Side, (by Rule I.) and then if both Sides be involved to the Power denominated by the Surds, an Equation will arise free from radical Quantities, unless there happens to be more Surds than one, in which case the Operation is to be repeated.
- Thus $\sqrt{x+4}=12$, by Transposition becomes $\sqrt{x=12-4}=8$; which, by squaring both Sides, gives x=64.
- So, likewise, $\sqrt{aa+xx-c}=b$, becomes $\sqrt{aa+xx}=b+c$, squared, gives aa-xx=bb+2cb+cc, then per Rule 1, $x^2=a^2+b^2+2cd+c^2$, and $x=\sqrt{a^2+b^2+2cd+c^2}$
- 5. Having, by the preceding Rules, if there is Occasion, cleared your Equation of fractional and radical quantities, and so ordered it, by Transposition, that all the Terms wherein the known Quantities are found, may stand on the same Side thereof, let the Whole be divided by the Co-efficients, or the Sum of the Co-efficients of the highest Power of the said unknown Quantity.
- Thus, if 6x=24, then will $x=\frac{24}{6}=4$; and if 4x=48-2x, then will 6x=48, per Rule 1, and $x=\frac{84}{6}=8$.

DU LOUIS

X A M P L E S.

For the Learner's Exercise in the aforegoing Rules, set down promiscuously,

1. If
$$20-3x-8=60-7x$$
, what is the Value of x?

2. When
$$5x-16=3x+12$$
, what is x?

3. If
$$\frac{3x}{4} + 5 = \frac{5x}{6} + 2$$
, what is x equal to?

4. If
$$\frac{7x}{8} - 5 = \frac{9x}{10} - 8$$
, what is x ?

5. When
$$\frac{5x}{9} - 8 = 74 - \frac{7x}{12}$$
, quere x?

6. If
$$56 - \frac{3x}{4} = 48 - \frac{5x}{8}$$
, what is the Value of x?

7. Required the Value of x, when
$$36 - \frac{4x}{9} = 8$$
?

8. When
$$\frac{2x}{3} = \frac{176 - 4x}{5}$$
, quere x?

9. If
$$\frac{45}{2x+3} = 4\frac{57}{4x-5}$$
, what is the Value of x?

9. If
$$\frac{42x}{2x+3} = 4\frac{37}{4x-5}$$
, what is the Value of x ?
10. If $\frac{42x}{x-2} = \frac{35x}{x-3}$, what is x equal to?

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11. If
$$\frac{xx-12}{3} = \frac{xx-4}{4}$$
, what is x equal to?

12. When
$$\frac{5xx}{16} = 8 + 12$$
, what is the Value of x?

13. Suppose
$$\frac{x+1}{2} + \frac{x+2}{3} = 16 - \frac{x+3}{4}$$
, quere x?

14. Suppose
$$ax+b^2 = \frac{ax^2+ac^2}{a+x}$$
, quere x?

15. If
$$\sqrt{\frac{5x}{3}} + 12 = 17$$
, what is x?

16. What is the Value of x, when
$$\sqrt{12+x}=2+\sqrt{x}$$
?

17. If
$$\sqrt{x} + \sqrt{a+x} = \sqrt{\frac{2a}{a+x}}$$
, what is x?

19. Suppose
$$\sqrt{a^2+x^2}=\overline{b^4+x^4}$$
, what is x equal to?

82. Of the EXTERMINATION of UNKNOWN QUANTI-TIES; or, the REDUCTION of two or more EQUA-TIONS to a Single One.

RULE.

r. Observe which of all your unknown Quantities is the teast involved, and let the Value of that Quantity be found in each Equation, (by the Rules already given) looking upon all the Rest as known; let the Values thus found be put equal to each other, (for they are equal) because they all express the same Thing; whence new Equations will arise, out of which that Quantity will be totally excluded, with which new Equations the Operations may be repeated, and the unknown Quantities exterminated, one by one, till at last you come to on Equation containing only one unknown Quantity.

Thus, Let the given Equations be x+y=12, and 5x+3y=50, to find x and y.

Now by transposing y and 3y we get x=12-y, and 5x=50—3y, from the last of which Equation, $x=\frac{50-3y}{5}$

Now by equating these two Values of x, we have 12-y=50-3y, and therefore 60-5y=50-3y, from which, $y=\frac{10}{2}=5$, and x=12-y=12-5=7.

- 2. Or, let the Value of the unknown Quantity, which you would first exterminate, be found in that Equation wherein it is the least involved, considering all the other Quantities as known; and let this Value and its Powers be substituted for that Quantity and its respective Powers in the other Equation, and with the new Equations thus arising, repeat the Operation, till you have only one unknown Quantity and one Equation.
- Thus, x being the first Equation, (in the last Example) =12-y, then by substituting this Value of x, in the second, that is 60-5y, must be wrote in the Room of its Equal 5x; whence will be had, 60-5y+=50; and from hence $y=\frac{10}{2}=5$, as before.

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3. Or, lastly, let the given Equations be multiplied or divided by such Numbers or Quantities, whether known or unknown, that the Term which involves the highest Power of the unknown Quantity to be exterminated, may be the same in each Equation, and then, by adding, or subtracting the Equations, as Occasion shall require, that Term shall vanish, and a new Equation emerge, wherein the Number of Dimensions, (if not the Number of unknown Quantities) will be diminished.

By multiplying the first Equation by 5, we shall have - 5x+5y=60 from whence subtracting the 2d Equation, viz. 5x+3y=50 there remains - 2y=10 whence

whence y=5, and x by the first or second Equation will be 7, still the same as before.

The first of these three Ways, is the most commonly used, but the last of them is, for the general Part, the most easy and expeditious in Practice.

EXAMPLES.

1. Let
$$\begin{cases} 5x + 8y = 106 \\ 4x - 5y = 5 \end{cases}$$
 quere, the Value of x and y ?
2. Let $\begin{cases} 5x - 3y = 150 \\ 10x + 15y = 825 \end{cases}$ quere, x and y ?

2. Let
$$\begin{cases} 5x - 3y = 150 \\ 10x + 15y = 825 \end{cases}$$
 quere, x and y?

3. Let
$$\begin{cases} \frac{x}{2} + \frac{y}{3} + \frac{z}{4} = 6z \\ \frac{x}{3} + \frac{y}{4} + \frac{z}{5} = 47 \\ \frac{x}{4} + \frac{y}{5} + \frac{z}{6} = 38 \end{cases}$$
 quere, x, y , and z ?

4. Let
$$\begin{cases} \frac{x}{4} + \frac{y}{5} = i5 \\ \frac{x}{6} + \frac{y}{9} = 9 \end{cases}$$
 quere, x and y ?

5. Given
$$\begin{cases} \frac{x}{2} - 12 = \frac{y}{4} + 8 \\ \frac{x+y}{5} + \frac{x}{3} - 8 = \frac{2y-x}{4} + 27 \end{cases}$$
 what is the Value of x and y ?

6. Given
$$\begin{cases} x+y=80 \\ x+z=70 \\ y+x=60 \end{cases}$$
 to find $x, y, \text{ and } z$?

7. Suppose
$$\begin{cases} x + 100 = y + z \\ y + 100 = 2x + 2z \\ z + 100 = 3x + 3y \end{cases}$$
 what is x , y , and z equal to?

8. Let there be given
$$x-y=2$$
, $xy+5x-6y=120$, to exterminate x?

9. Let
$$\begin{cases} x+y=s \\ x^2-y^2=d \end{cases}$$
 quere, x, y , and z ?

10. Let
$$\left\{ \begin{array}{l} x+y+z=12 \\ x+2y+3z=20 \\ \frac{x}{3}+\frac{y}{2}+z=6 \end{array} \right\}$$
 quere, x, y, and z?

83. QUA-

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83. QUADRATIC EQUATIONS.

A quadratic Equation is, when it involves one unknown Quantity, and at the fame Time the Square of that Quantity, and the Product of it multiplied by some unknown Quantity.

Of these Equations there are three Forms, viz.

$$xx+6z+12=52$$
 the first Form.
 $2xx-6x+12=20$ fecond.
 $6x9-x=8$ third.

All of which may be folved by the following

RULES.

r. Transpose all the Terms that involve the unknown Quantity to one Side, and the known Terms to the other Side of the Equation.

2. If the Square of the unknown Quantity is multiplied by any Co-efficient, you are to divide all the Terms by that Co-efficient, that the Co-efficient of the Square of the unknown Quantity may be Unit.

3. Add to both Sides the Square of half the Co-efficient prefixed to the unknown Quantity itself, and the Side of the Equation that involves the unknown Quantity will then be a complete Square.

4. Extract the Square Root from both Sides of the Equation, which you will find on one Side always to be the unknown Quantity with Half the aforefaid Co-efficient fubjoined to it, fo that by transpoung this Half, you may obtain the Value of the unknown Quantity expressed in the known Term.

Thus, by Rule 1, the three aforefaid Equations will become as follows:

First
$$xx+6x=52-12=40$$

Second $2x^2-6x=20-12=8$
And Third $x^2-6x=-8$

And by Rule 2, the fecond Equation will become $xx - \frac{6x}{2} = \frac{8}{2}$, confequently $x^2 - 3x = 4$.

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PROJET!

Then, by Rule 3, these three Equations will become as follows, viz,

First
$$x^2+6x+9=40+9=49$$

Second $x^2-3x+2,25=4+2,25=4=6,25$
And Third $x^2-6x+9=9-8=1$

Alfo, by Rule 4, they will become as follows.

First
$$x+3=\sqrt{49}=7$$

Second $x-1,5=\sqrt{6},25=2,5$
And Third $x-3=\sqrt{1}=1$

Then by the Rules of Reduction,

$$\begin{array}{l} x = 7 - 3 = 4 \\ x = 2.5 + 1.5 = 4 \\ x = 1 + 3 = 4 \end{array}$$
 for $x = 4$.

All Quadratic Equations may be folved by the following general Theorem.

Thus, suppose the second Equation was required to be resolved.

First let
$$A=2$$
, $B=6$, and $C=8$.
Then it will stand $Axx-Bx=C$.
Per Rule 2, $xx-\frac{Bx}{A}=\frac{C}{A}$

Also, per Rule 3, $xx - \frac{bx}{a} + \frac{bb}{4aa} - \frac{bb}{4aa} + \frac{c}{a}$, but the two

Fractions $\frac{bb}{4aa}$ and $\frac{c}{a}$, when thrown into one, give $\frac{abb+4aac}{4aaa}$ which divided by a, gives $\frac{bb+4ac}{4aa}$, therefore $\frac{bx}{4aa} + \frac{4aa}{bb} = \frac{bb+4ac}{4aa}$.

Now let
$$bb+4ac=ss$$
, then the equation will stand thus,
 $xx-\frac{bx}{a}+\frac{bb}{4aa}=\frac{ss}{4aa}$, then per Rule 4, $x-\frac{2a}{b}=\frac{s}{2a}$.
therefore, $x-\frac{b+s}{2a}$, that is, $x=\frac{b+s}{2a}$, or, $x=\frac{b-s}{2a}$.
Q E. F.

EXAMPLES.

1. Suppose xx-4x=32, what is the Value of x?

2. Suppose 12xx-420x=-1200, quere x?

3. Suppose 4x2 +60x=216, what is x equal to?

Suppose a=21, or any other Number, and e=7, the leffer Number:

Then let
$$\begin{cases} a+e=s=28\\ a-e=d=14\\ ae=p=147 \end{cases}$$

$$\begin{cases} a+e=s=28\\ ae=p=147 \end{cases}$$

$$\begin{cases} a-e=d=14\\ ae=p=147 \end{cases}$$

$$\begin{cases} a-e=0 = 147\\ a=0 = 147 \end{cases}$$

$$\begin{cases} a-e=0 = 147\\ ae=0 = 147 \end{cases}$$

$$\begin{cases} a-e=0 = 147 \end{cases}$$

$$\begin{cases} a-e=0$$

Any two of these six Letters (s, d, p. q, x, z,) being given, to find the rest; which admits of 15 Variations or Questions, and are those which Mr. WARD has so excellently answered in his MATHEMATICIAN'S GUIDE.

Question 1. Suppose s and d were given, and it were required by them to find a, e, p, q, z, and x.

2. Let s and p be given, to find the rest.

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3. Suppose s and q were given, to find the rest.

4. Suppose s and z were given, to find the rest. 193

5. Let s and x be given, to find the rest.

6. Suppose d and p are given, to find the reft.

7. Let d'and q be given to find the rest.

8. Suppose d and z are given, to find the rest.

9. Suppose d and ware given, to find the rest.

10. Let p and g be given, to find the rest.

Support and the given, to find the rest.

12. Let p and a be given, to find the rest.

13. Suppose q and z were given, to find the rest.

14. Let q and x be given, to find the rest.

15. Suppose z and x were given, quere the rest?

These fifteen Questions being pursued throughout, to find the Value of all the unknown Quantities, will afford a great Variety, and will be found to be of great Service to the Pupil, in the Solution of most Questions.

Note.

Note.—I would advise the Learner, to use the same Numbers, for the respective Value of each Quantity, throughout all the Questions, as they will be more satisfactory in proving the Work, than Various Numbers will be; not but any Number may be taken at Pleasure, provided the Number represented by a be greater than that by e, &c.

The Pupil may make a Numerical Calculation in each Question.

PROBLEMS.

1. What two Numbers are those, whose Difference is 20, and whose Sum is 70?

2. What two Numbers are those, whose Difference is 14, and the Quotient of the greater divided by the less is 3?

3. What Number is that, whose third Part, added to its fourth, will be 21?

4. What Number is that, whose third Part exceeds its fourth by 4?

5. What Number is that, whose third Part less 4, is equal to its fourth less, 25?

6. What Numbers are those, whose Difference is 8, and the Difference of their Squares is 208?

7. What two Numbers are those, whose Sum is 60, and the greater is to the lesser, as 9 is to 3?

8. Find two Numbers, the Product whereof is 108, and the Triple of the greater divided by the lesser is 4?

9. Find two Numbers, to whose Sum, if you add 8, the Whole will be double the greater, and if you subtract 4,5 from their Difference, the Remainder will be Half the least?

no. Find three Numbers, fo that the first, and half the Remainder, the second and one-third of the Remainder, and the third and one-fourth the Remainder, may always make 34?

of the first Division may be three Times the minor Part of the fecond Division, and the major Part of the second may be double the minor Part of the first?

12. Three Persons, A, B, and C, make a joint Contribution, which in the Whole amounts to 761. of this A contributes contributes a certain Sum unknown; B. as much as A. and 101. more; and C. as much as both A. and B. together: I demand their feveral Contributions?

13. There are 480 Men to be placed in an Oblong, whose Length and Breadth together make 52: How many in

each Side?

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14. Sold a Quantity of Tobacco for 19s. Part of which at 1s. per Pound, and the Rest at 15d. now the first Part was to the latter as $\frac{3}{4}$ to $\frac{2}{3}$: How much was fold of each Side?

15. After paying away \(\frac{1}{4}\) and \(\frac{1}{3}\) of my Money, I found 66 Guineas left in my Bag: What was it at first?

16. What two Numbers are those, whose Sum, multiplied by the greater, produces 77; and whose Difference, multiplied by the lesser, gives 12?

17. What Number, from whose Double 10 being subtracted, the Square of the Remainder less 1 will be equal to 7

Times the faid Number?

18. A Father at his Death left, by his Will, 1000l. to be divided between his Son and Daughter, in such a Manner that \(\frac{1}{5}\) Part of his Share should exceed \(\frac{1}{4}\) Part of her's by 10l. how must the 1000l. be divided?

19. The continual Product of four Numbers in Arithmetical Progression is 945, and the common Difference 2;

what are those Numbers?

20. If to my Months you should add Half this Sum, And one-eighth more, and then should subtract one, The Residue would such a Number be As twenty-one, being squared, assuredly?

21. Three Numbers in Geometrical Progression are required, fo that the Difference of the first and second may be 6,

and of the fecond and third 15?

22. To find a Number, from the Cube of which if you subtract 19, and multiply the Remainder by that Cube,

the Product shall be 216?

23. Sixty Thousand brave Soldiers in Battle there were Plac'd on a vast Plain, and in Form a long Square:
Now on how many Acres of Ground did they stand,
At two Yards three Quarters between Man and Man;
And how many in Rank and File will there be,
When their Breadth to their Length is as two is to three?

24. A General, disposing of his Army into a square Battle,

finds he has 284 Soldiers over and above, but increasing each Side with one Man, he wanted 25 to fill up the Square: Quere, the Number of Soldiers?

25. Old John, who had in Credit liv'd,
Tho' now reduc'd, a Sum receiv'd;
This lucky Hit's no fooner found,
Than clam'rous Duns came fwarming round;
To th' Landlord—Baker—many more,
John paid in all, Pounds ninety-four.
Half what remain'd—a Friend he lent,—
On Joan and 'Self, one-fifth he fpent;
And when of all these Sums berest,
One-tenth o' th' Sum received had lest;
Now shew your Skill, ye learned Youths,
And by your Work the Sum produce.

26. In a Rectangle, ABCD, is given the Difference between the Length, AB, and the Diagonal, BD, that is, DE=2; likewise the Difference between the Breadth, AD, the Diagonal, BD, that is, FE=9, required the Sides of the Rectangle, AB, AD?

AB=13, AC=14, BC=15, and the Perpendicular AD being drawn, required the Segment of the Bases BD, DC?

23. Suppose the Plate of a Looking-Glass is 18 Inches by 12, and is to be framed with a Frame of equal Width, and whose Area is to be equal to that of the Glass, the Width of the Frame is required? Ans. 3.

29. One Morning in May I went to furvey,

As foon as bright Sol I espy'd;
I measured round a four corner'd Ground,
The Margin's * the Length of each Side:

The Angle at B, together with D,
An hundred and fifty Degrees;
The Meadow's Content is all that I w

The Meadow's Content is all that I want, Assist me, kind Youths, if you please?

30. A Gentleman a Garden had,
Five Score Feet long, and four Score broad:
A Walk of equal Breadth, half round,
He made that took up Half the Ground:
The Figure in the Margin fee,
How wide's the Walk? I pray tell me.

A B=15.60 B C=13.20 CD=10.00 DA=26.00



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31. Ye young Artists be so kind
The Fences of a Field to find;
Triang'lar is the Form of Ground,
Its Area twice twelve Chains was found;
One at the Base I knew,
Just thirty-fix and fifty-two;
And cub'd when every Side shall be,
The Sum you in the Margin see * 1728 Chains.

For more Examples, fee Sect. 30 and 31.

A few diverting QUESTIONS.

t. A Cheshire Cheese, when in one Scale, weighed 76lb. but on being changed into the other Scale, it weighed only 56lb. Quere, the true Weight? Ans. 65, 1965lb.

The general Rule for Questions of this Sort is, to multiply the two Weights together, and extract the Square Root of the Product, which Root will be the true Weight.

2. A Stone, weighing 40lb. is by Accident broken into four Pieces, by which may be weighed any Number of Pounds, from 1lb. to 40lb. Quere, the Weight of each Piece?

A General RULE for the Solution of QUESTIONS of this Nature.

To double the first or least Weight, which always contains

one Pound, add 1, and it gives the fecond Weight.

Again, to double the Sum of these two Weights, add 1, it produces the third Weight: And again, to double the Sum of these three Weights, add 1, and we shall have the fourth Weight.

3. A certain Company being at a Public House, their Reckoning came to 6s. 4d. the Number of Persons in Company were equal to the Farthings each spent: Quere, the Number in Company, and what each spent?

The General Rule to answer Questions of this Sort, is to reduce the given Sum to its lowest Name mentioned, and of which extract the Square Root, which will be the Answer.

Dd 2

4. A Pack of Cards being laid into any Number of Heaps, fo that the Spots on the bottom Card of each Heap, added to the Number of Cards laid thereon, may make 12, by giving the Number of Heaps, and of the Cards left out, to find the Number of Spots on all the bottom Cards?

QUESTIONS of this Nature are folved by the following Theorem:

Suppose n=the Number of Heaps,
r=the Number of Cards lest,
w=the whole Pack,
x=the Number of Spots required.

Then the Theorem will be 13n-w+r=x, the Number

of Spots required.

Suppose a Pack of Cards be dealt into 7 Heaps, and then there is 12 Cards left out: Quere, the Number of

Spots on all the bottom Cards?

5. What Dimensions must I give to a Joiner to make a Cubical Box that will hold 2000 Oranges of 24 Inches Diameter each, supposing the Oranges globular, keeping that Form, and laid in Rows exactly at the Top of

each other? Anf. 31,498 Inches infide.

6. A Master Joiner gives to one of his Men a Plank that is 10 Feet by 2, with Orders to make of it a Square Table, equal in Area to the said Plank, but not to exceed six Segments; the Poor Man being ignorant of Lines (and not willing his Master should know it) would be greatly obliged to any who will draw the Plan how the said Plank must be cut and applied together?

7. A Person being asked what Hour of the Day it was, answered, It is between 5 and 6, and both the Minute Hand and Hour Hand are together: Required the

Hour of the Day?

8. A Lady has a Dreffing-Table, each Side of which is 27 Inches, but she is desirous to know how each Side of the same may = 36 Inches, by having 4 Foot of Plank, superficial Measure, joined to the same. The Plan in what Manner the Plank must be cut and applied to the Table is required?

9. A

9. A Gentleman purchases a Piece of Land in
Form of a Parallelogram, and incloses
one-fourth Part (as per Figure) to build
a House and other Conveniencies upon;
now he desires the Remainder of this Land
may be divided into four Parts, equal
and similar to each other, to be appropriated to such Uses as he shall hereaster think proper;
the Plan is desired?

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in ne 10. Required to divide a given Trapezium, of two equal Parts, (Geometrically) by the shortest Line possible?

11. A Person, for a considerable Wager, is to travel from a Town A, to another B, but he is to call at a Place which is somewhere on the Line ab: Now his Time limited being very short, he is desirous to know (by Geometry) the Situation of the Place on the Line ab, the Distance from thence to A and B being the shortest possible.

A B

12. All the different Ways possible in which a Gentleman can place his Servants, combining them by 1, 2, 3, &c. at a Time are 960799: What Number of Servants does he keep?

GENEALOGICAL PARADOXES.

gether, and were met by another Person, who asked the Boys in what Relation they stood to each other; they replied, We are Sons and Grandsons by the Father; Brothers and first Cousins by the Mothers; who also are Aunts to each of us. This Combination of Kindreds once happened, but in what Manner? See Gen. xix.

2. Who was he that was begot before his Father, born before his Mother, and had the Maidenhead of his Grandmother?

APPENDIX.

CONTAINING

Various Forms of Acquittances, Promissory Notes, Bills of Exchange, Letters of Advice, Letters of Credit, Bills of Parcels, and Bills on Book Debts, all of which are adapted to such Circumstances as occur in real Business, to enter a Pupil in the Manner and Method of Commerce, and to make him ready at Computation.

A general Receipt.

RECEIVED August 9th, 1784, of Mr. Anthony Buskin, the Sum of Fifty Pounds, in full for one Quarter's Rent, due at Midsummer last, and of all Demands,

By me HENRY HEDGES.

£ 50 00 00

A Receipt or Acquittance for Rent paid.

Received this 5th Day of January, 1784, of Mr. Thomas Field, the Sum of Thirty-two Pounds Sixteen Shillings in Money, which with Eight Pounds Four Shillings more, disbursed by the said Thomas Field for Taxes and Reparations of the Messuage and Tenements he now occupies, situate

fituate in Chiswell-street, London, makes in the whole the Sum of Forty Pounds, and is in full of Half a Year's Rent due to me out of the said Premises at Michaelmas Day last.

—I say received by me,

£ 40 00 00

THOMAS ROSE.

An Acquittance for Debt received of a third Hand.

RECEIVED this 10th Day of July, 1784, of Mr. Joseph Stanley, by the Hands of Mr. Clark Stanley, the Sum of Seven Pounds, in full for certain goods bought by the faid Joseph Stanley of me.—I say, received in full of all demands, by me,

£7 00 00

FRANCIS CRUMP.

An Acquittance for Money received in Part of a Debt due on bond.

RECEIVED this 16th of June, 1784, of Mr. Thomas Brown, the Sum of Ten Pounds Ten Shillings and Six Pence, in Part of Payment of a greater Sum, due to me on Bond from the faid Thomas Brown.—I fay, received by me,

£ 10 10 06

THOMAS HEDGES.

An Acquittance for Money received by a third Person for the Use of another.

RECEIVED this 18th Day of March, 1784, of Mr. Edward Hedges, the Sum of Twenty Pounds, in full for Work done by Charles Day, for the faid Mr. Edward Hedges.—I fay, received by the Order, and for the Use of the faid Charles Day, by

£ 20 00 00

THOMAS WOOTTON.

A Receipt for Interest due on Bond.

RECEIVED this 13th Day of January, 1784, of Mr. Abraham Brooks, the Sum of Five Pounds, in full for one Year's Interest, of 100l. due to me at Christmas last, on Bond from the said Abraham Brooks.—I say, received by me,

DAVID BURN.

£ 5 0 0

Note, Besides these Receipts to be taken on Payment of Money due on Bonds, it is proper to have each Payment mentioned on the Back of the Obligation.

An Acquittance for a Legacy.

RECEIVED this 29th Day of July, 1784, of John Roberts, Executor of the last Will and Testament of Samuel Green, late of Westham, in the County of Essex, deceased, the Sum of One Hundred Pounds, in full of a Legacy bequeathed to me, in and by the last Will and Testament of the said Samuel Green.—I say, received in sull of all Demands, by me,

JOHN JARRETT.

£ 100 0 0

An Acquittance to an Administrator on Payment of a Debt due from the Intestate.

RECEIVED this 30th Day of July, 1784, of Mr. Wm. Jarrett, Administrator of the Goods and Chattels, Rights, and Credits of John Noon, late of Bristol, in the County of Somerset, deceased, the Sum of Three Hundred Pounds, in sull of a Debt owing me by the said John Noon in his Life-time, for Houshold Goods by me sold him.—I say, received in sull of all Demands, by me,

€300 00 00

GEORGE CHINNER.

A Receipt proper to be taken upon a Person's giving a Promissory Note for a Book Debt.

RECEIVED this 20th Day of April, 1784, of Mr. Wm. Straight, a Promiffory Note for the Sum of Sixty Pounds, payable to me or Order three Months after Date, which Sum when paid is in full of all Demands.—I fay, received by me,

£ 60 00 00

THOMAS Ross.

An Acquittance for the Purchase-Money on executing of a Conveyveyance, to be indorsed on the Back of a Deed.

RECEIVED the Day and Year within written, of the within named Thomas Biffon, the Sum of Seventy Pounds, being the full Confideration Money within mentioned to be paid to me.—I fay, received by me,

€ 70 00 00

CHARLES BARRON.

Witness to the Payment {
 of the Money.

A Receipt for Writings entrusted in a Person's Hand.

RECEIVED this 25th Day of Nov. 1784, of John Stag, of Eye, in the County of Suffolk, four feveral Deeds or Conveyances; one of them purporting to be a Leafe of a Messuge, situate in Narrow-street, Lime-House, and made between John Lee of Wapping, and William Burt of Westminster; another to be an Assignment of the said Lease, and made between John Vyse of New-street, London, and Felix Morgan of Bangor, in the County of Carnarvon; and the other to be a Lease and Release, and made between John Jee of Barking, in the County of Essex, and John Bevan of Newhaven, in the County of Sussex; for which several Deeds or Writings, I hereby promise to be accountable, and to re-deliver the same to the said John Stag on Demand.

HENRY WRIGHT.

Witness my Hand,

The Form of Promissory Notes, or common Notes for Money.

The Form of one payable on Demand.

I PROMISE to pay to Anthony Wilson or Order, the Sum of Twenty Pounds on Demand, for Value received. Witness my Hand this first of January, 1784.

HENRY WILSON.

£ 20 00 00

The Form of one payable at a certain Time.

London, January 4, 1784.

THREE Months after Date, I promife to pay to Mr. Aaron Brooks or Order, the Sum of Ten Pounds, for Value received by me,

CHARLES VYSE.

£ 10 00 00

Form of one payable at fundry Times.

I PROMISE to pay Sir Aaron Day or Order, the Sum of Thirty-fix Pounds, in the Manner following: Ten Pounds, Part thereof, three Months after Date, Sixteen Pounds more the 20th of May next, and the remaining Ten Pounds the 27th of July next following, for Value received. Witness my Hand at London, the 2d of January, 1784.

JOHN COWCHEE.

£36 00 00

Form of one for Goods received.

I PROMISE to return John Whyley, Efq. or Order, on Demand, one Casket of Jewels, sealed, One Hundred Ounces of Gold Plate, Three Hundred and Fifty of Silver ditto, One Hundred Carats of Oriental Pearl, and a Five Hundred Pound Bank Note.—Received of the said John Whyley, Esq. for Self and Company, March 4th, 1784, by me,

JAMES COWCHEE.

Form of Inland Bills of Exchange.

Form of one payable at Sight.

£ 100

Bristol, January 14, 1784.

AT Sight pay Mr. John Barwick or Order, the Sum of One Hundred Pounds, the Value received of Mr. James Barwick, and place it to Account as per Advice from

WM. BARWICK.

To Mr. Charles Davis, at the Horfe-guards, Whitehall, London.

Form of one payable after Sight.

£ 64 17 6

London, June 12, 1784.

AT Ten Days Sight pay Mr. William Straight or Order, the Sum of Sixty-four Pounds Seventeen Shillings and Six Pence, the Value received, for Thomas Johnson, Esq, and place it to Account as per Advice from

GEORGE DEAR.

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To Mr. Thomas Lawr, Clothier, Salifbury.

Form of one payable after Date.

£70

Edinburgh, July 2, 1784.

THREE Months after Date pay Sir John Walker or Order, the Sum of Seventy Pounds, Sterling, Value in Ourselves, and place it without more Advice to the Account of

THOMAS and JAMES BURN.

To Sir Thomas Biffor, Lombard-street, London.

£ 40

London, Nov. 24, 1784.

Meffrs. Fox and Payn,

PAY Thomas Stanley or Bearer, Forty Pounds on Account.

THOMAS PETTIT.

Another

Another.

SIR,

York, June 4, 1784.

PAY Mr. Thomas Rofs, or Bearer, One Hundred Pounds, on Demand, and place it to my Account.

THO. CLIFFORD.

To Mr. John Hawkins, Silversmith Whitechapel.

Form of Foreign Bills of Exchange.

For Crowns 600 at Usance.

London, July 12, 1784.

London on Paris. First Bill. At Usance pay this First of Exchange to Henry Gibbins or Order, Six Hundred Crowns for the Value here received of Samuel Drummond, and place it to Account, as per Advice from

JOHN PLAW.

To Mr. George Pain, Merchant, at Paris.

For Crowns 600 at Usance.

London, July 12, 1784.

Second Bill. AT Usance pay this my second of Exchange, my first not paid, to Joseph Lindman or Order, Six Hundred Crowns for the Value received of Sir George Wayer, and place it to Account, as per Advice.

THOMAS SWIFT.

To Mr. Robert Clifford, Merchant, at Paris.

£602 15s. 3\frac{1}{4} Sterl. at 34d\frac{1}{4}
per £. Sterl. Ufance.

London, Sept. 6, 1784.

London on Rotterdam. First Bill. AT Usance pay this First of Exchange to James Vyse or Order, Six Hundred and Two Pounds Fifteen Shillings and Three Pence One Farthing Sterl. at Thirty-four Pence One Farthing Flem. per Pound Sterl. Value of Samuel Turner, Esq. and place it as per Advice from

Your most humble Servant,

THOMAS WOOLDRIDGE.

To Mr. Samuel Cook, Mer- chant, at Rotterdam.

Form of a Factor's Remittance to his Employer.

For Crowns, 700 at 5s. 4d. Sterl.

Genoa, Sept. 6, 1784.

AT Twenty Days fight pay this my first of Exchange to Thomas Godfrey or Order, Seven Hundred Crowns Exchange, at Fifty-four Pence per Crown, Value received of the Lords of the Regency, and place it to the Account of Mr. Wm. Stanes, of Lyons, as per Advice from him,

GEORGE WARD.

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H B pl la

hu

To Mr. Francis Baker, Banker, Lombard-street, London.

Mr. William Stanes's Letter, advising his Concurrence to the aforementioned Draught.

Lyons, Sept. 30, 1784.

SIR,

BROTHER George Ward, of Genoa, has this Day defired me to furnish him with Seven Hundred Crowns, pay-

able to the Resident of the States at London. I have therefore ordered him to draw for the said Sum on you, which please to honour as usual, and put it to the Account of

Your Friend and Servant,

WILLIAM STANES.

To Mr. Francis Baker, Banker, Lombard-street, London.

Form of a Draught on the Employer for Value of Goods shipped him per Factor.

Milrees 400 at Ufance

St. Andrews, June 24, 1784.

North Britain on Lisbon. AT Usance pay this my first of Exchange to Mr. Edward Ross or Order, Four Hundred Milrees, the Value here shipped for your Use, upon the Santa Maria of Naples, and consigned as per Advice from your very humble Servant,

MICHAEL GODFREY.

To Signior Santilena, at Lifbon.

Form of an Employer's Letter with Remittance to his Factor, in & Bill of the faid Factor's Correspondent.

Mr. Thomas Dale,

ACCORDING to your Defire I have remitted you Four Hundred Crowns for my Accompt, in your Correspondent Baker's Bill inclosed, payable by and to yourself, for which please to give me credit; I recommend the Contents of my last and the 4th Current to you, and rest your Friend and humble Servant,

EDWARD BAKER.

Paris, Sept. 14, 1784.

For

For Crowns 400, at 34d. per Crown.

Paris, Sept. 14, 1784.

The Bill.

AT double Usance pay this my only Bill of Exchange to myself, the Sum of Four Hundred Crowns, Exchange at Thirty-four Pence, Sterl. per Crown, the Value received of Mons. Edward Baker, and place it as per Advice to to the Accompt of

Your humble Servant,

HENRY VYSE.

To Thomas Day, Merchant, at Briftol.

Form of the Correspondent's Letter of Advice.

Mr. Thomas Day,

SIR,

Paris, Sept. 14, 1784.

BY this Post I have drawn on you for Four Hundred Crowns, at 34d. payable to yourself, Value of Mons. Edw. Bakerman, which with my other Bills depending please to honour, and the timely Remittance shall be punctually made you by

SIR,

Your very humble Servant,

NICHOLAS BROWN.

To Mr. Timothy Bevan, Merchant, Bristol.

Form of Letters of Credit.

SIR,

London, June 12, 1784.

PLEASE to furnish the Bearer hereof, Mr. Thomas Cavendish, with the Sum of One Hundred Pounds, as he shall require the same, and place it to my Account, for which this Letter of Credit, with his Receipt, shall be your sufficient Voucher and Warrant, giving upon Payment a Line or two of Advice to

Your real Friend,

FRANCIS Ross.

To Mr. John Day, Mer- }

The Receipt.

RECEIVED July 6, 1784, of Mr. Robert Berry, the Sum of One Hundred Pounds, by Virtue of Mr. Francis Ross's Letter of Credit of June 12th last, for the said Sum, per

MICHAEL NICHOLS,

£.100 0 0

Dublin, May 7, 1784.

SIR.

THE Bearer, Mr. Thomas Vyse, will have Occasion for Sixty Pounds, which Sum I desire you to furnish him, and take his Bill for the said Sum, or any Part thereof, on the Honourable William Webb, Esq.

I am, Sir,

Your humble Servant,

RICHARD KIRK.

To Henry Hedges, Elq. 3
Fleet-street, London. F.e 3

Exch.

Exch. £70

SIR,

June 4, 1784.

The Seventy Pounds, the Value received of Ditto for your Use, as per Advice from, Sir,

Your humble Servant,

THOMAS VILE.

To the Hon. William Bay, Efq. Dublin.

Exch. £70.

SIR.

June 4, 1784.

AT Twelve Days Sight pay this my Second of Exchange, my first not paid, to Richard Kirk, Esq. or Order, the Sum of Seventy Pounds, the Value received for your Use, of Henry Hopkins, Esq. as by Advice from

Your humble Servant,

THOMAS WILKS.

To the Hon. William Bay, Efq. Dublin.

Form of a general Letter of Credit, to furnish a Person according to his Occasion.

SIR,

Paris, May 12, 1784.

THE Bearer, Mr. Aaron Babel, one of his Britannic Majesty's Messengers, being ordered to Constantinople, will have Occasion for Money to defray his Charges, &c. Please to furnish him with the Sums he shall require at the said Place, taking his Receipts, and your Draught for the Value shall receive due Honour from

Your humble Servant,

MICHAEL WELLS.

Monf. Carter Day, Banquier, a Vienna.

For

For 600 at Liv. 31. 4s.

SIR.

Vienna, June 2, 1784.

AT Three Days Sight pay this my only Bill of Exchange, to Edward Fay or Order, the Sum of 600 Florins, Exchange at three Livres four Sols per Florin, the Value paid at Constantinople to Aaron Babel, pursuant to your Letter of Credit of the 12th of May last, and as by Advice from the said Aaron Babel.

RICHARD STANES.

A Monf. Henry Hedges, Banquier, a Paris.

Bills of Parcels, and Book Debts.

(1.) Mr. A. B.

Bought of THOMAS GROCER, Jan. 2, 1784.

and the second second		s.	d.		r.	s. d.
4lb. of Green Tea,	_	at 17	6	per lb.		
12lb. of Bohea, —	_	7	103	<u> </u>		*
5 Hundred of Tobacco,	_	6	0	per C.		
10 Barrels of Raifins	_			per B.		
9lb. of Pepper —	_	2	9	per lb.		
7lb. of Brimstone, -		- I	81			
8lb. of Coffee, —	-	12	9_			
770z. of Mace, -	-	. 1	$6\frac{1}{2}$			

6144-19.3

(2.) Mrs. T. G.

Bought of THOMAS SILK-MERCER, Jan. 7, 1784.

s. d. £. s d.

20 Yards of Brocaded Sattin, at 17 9 per Yd.

36 Yards of Mohair, — 10 8 —

86 Ditto of Green Silk Damask, 19 11½ —

100 Ditto of Paduasoy, — 11 10 —

9 Ditto of double Taffaty, — 3 9 —

12 Yards of ditto, — 5 6 —

6 Yards of ditto, — 9 11½ —

42 Yards of ditto, — 10 6 — £./.3/ 7/1

(3.) The Hon. Lady B.

Bought of J. LINEN-DRAPER, Jan. 6, 1784.

Bo Ells of Dowlafa,	at	s. d.	per Yd.	
6 Ells of Holland,	-	5 71/2		
19½ Ells of Diaper,	-	1 7	-	
7 Yards of Damask,		4 10		
2 Yards of Muslin,	-	11 0		
4½ Ells of Cambric,	-	5 6		

(4.) Madam B.

Bought of B. MILLINER, Jan. 4, 1784.

	S. d. f. S. d.
261 Yards of blue Ribbon, at	2 6 per Yd.
12 Fans, French Paper Mount	, 4 9 each.
6 Pair of Roman Gloves,	9 6 per Pr.
4 Dozen of Irish Lamb ditto	1 10½ ——
6 Sarfenet Hoods, white,	5 II each.
A Piece of Mechlin Lace, 123	7. 17 6 per Yd.

(5.) Mrs.

(5.) Mrs. F. PINDUST,

Bought of	Tuanta	Harren	Inter to	1221
Donaut or	THOMAS	TIOSIEK,	July 129	1704.
The second secon				

	s. d. £. s. d.
28 Pair of Thread Stockings, at	4 6 per Pr.
1½ Dozen of Worsted, mixt,	3 10
18 Pair of Strawberry Hofe,	4 0
16 Pair of Silk Gloves, -	5 111
74 Pair of Norwich Hose, -	2 6
Pair of Mens Yarn, ————————————————————————————————————	3 0
11½ Dozen ditto, Silk, — —	16 6 —
	

(6.) Mrs. Ann Scott,

Bought of JOHN FRUITERER, May 7, 1784.

	s	. d.			£.	5.	d.
6 Dozen of Lemons, at	2	10	per	Do	oz.	9 1000	
41 Hundred of Lisbon ditto	6	6	per	Hu	ın.		
ro Ropes of Onions, —	I	9	eac	h.			
17 D. Seville and China Oranges,	4	6	pe	r Do	oz.		1
A Bushel of Chesnuts,		-		-		10	6
6 Dozen of Pomegranates,	4	10					

(7.) Mr. C. Toms, Bought of Mr. James DRAPER, Feb. 4, 1784.

12 ⁷ / ₈ Yards of Broad Cloath, at 17 Yards of fine Spanish black, 14 ⁵ / ₈ Yards of fine Grey Cloth, 6 ¹ / ₂ Yards of fecond Drab, —	71 1365	10	per Yd.	
273 Yards of Shalloons, ————————————————————————————————————	1 4	9		

(8.) Mr.

(8.) Mr. W. L.

Bought of	ANDREW	OILMAN,	March	7. 1	784.
	Date	~ 1 L M 11 1,	TITUICII	/ , .	104.

	5.	d.	£.	s.	d.
12lb. of Anchovies, at	I	6	per lb.		
6½lb. of Capers, —	0	III	1		
26lb. of Salt, — — —			-	nns/A	1 11
4 Gallons of pickled Mushrooms,	3	6	per gal.	0 %	
3 Gallons of Lucca Oil, -	ID	6	3 13 10 1	0.101	1
12lb. of Salt-Petre, -	1	44	per lb.	e sid	9
				n	-

(9.) John Jones, Efq.

Bought of Tho. CHEESEMONGER, Jan. 16, 1784.

	C. gr.	lb.	5.	d.	
6 Old Cheshire Cheeses, W	t. 3 2		44	6	per C.
3 Gloucestershire ditto,	232		36	4	
8 Flitches of Bacon, —	50 Sto	ne -	- 2	114	per St.
To Firkins of Butter, -	-		32	6	each.
24 Stilton Cheeses, —	6 2	9	37	10	per C.
3 Weys of Suffolk Butter,	a (7 a ()	_	132	6	each.
				1	2 1-757-195
		101	1009	F.	Boot k

(10.) Sir Matthew Lamb,

Bought of NATH. WINE-MERCHANT, Oct. 4, 1784.

	s.	d.	_ £.	5. 6
12½ Dozen of Claret Wine, at			Doz.	
4 Gallons of Canary, —	9	6 per	Gal.	
2 Hhds of old Mountain,	6	4 .		
26 Dozen of Madeira, —	30	6 per	Doz.	
Dozen of Tent, —	CARLES POSSESSON	10 -		BALTER S
4½ Dozen of Red Port, -	19 1	10 -	<u> </u>	COURSE N

(11.) Mrs.

(11.) Mrs. B.

(11.) WIIS. D.	
17841 (7833) (7833) (7833)	Bought of J. BUTCHER.
Jan. 2. A fore Quar. Lamb, wt 29. Ditto of Pork, Feb. 4. A Buttock of Beef, 10. A Fillet of Veal, 27. A Surloin of Beef, Mar. 6. Beef Steaks, 14. A Saddle of Mutton.	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
were a record and a section of	£
(12.) JOHN THOMAS,	
Bought of J. Corn-CH	IANDLER, March 4, 1784.
4 Quarters of Barley, at 12 Bushels of Wheat, 7 Ditto of Oats, 20 Bushels of Beans, 18lb. of Hops, 4 Loads of Hay,	s. d. £. s. d. 16 9 per Quar. 5 9 per Bush. 11 9 per Quar. 4 6 per Bush. 1 9 per lb. 50 0 per Load.
(13.)	Sept. 6, 1784,
Mr. Jones, Dr.	To J. COAL-MERCHANT.
Feb. 17. 4 Sacks of Coals, a Mar. 4. $5\frac{1}{2}$ Chaldrons of ditto, 16. 8 Sacks of ditto, 27. 9 Sacks of ditto, Apr. 6. 7 Sacks of ditto, 20. 3 Sacks of ditto,	

£. (14.) Thomas

(14.) Thomas Johnson,

Bought of John GROCER, June 27, 1784.

12 Hhds of Tobacco, 9 Barrels of Raisins,	wt.	6	1	lb. 24	at	53	d. 6 8	£.	s. d.
2 Ditto of Rice, 8 Bags of Pepper,	-	3	1	27			11		ds E
Brimstone, 4 Hhds of Sugar,		3 4		1 1 100		²⁷ 33			
							£		

(15.) Mr. John Man,

Bought of John Jee, Aug. 27, 1778.

6 Casks of Barbadoes Sugar, at 2 Months credit, viz.

• •				C.	q.	lb.		9.		
No.	T.		wt.	10	0	24	Tare	3	10 ea	ch.
	2.		-	98	2	17				
	3.		_	8		20				
	4.		_	11	2	17				
-	6.	•	-	10	1	1				
	6.		_	9	3	19				
9			Grofs,							
	1		Tare,							
			Neat,			8	t 535	64	. per	Cwt.
and the		Manager and the second	The San Street							

(16.) Mr. John Ross,

Bought of JOHN MACKINDER, Aug. 30, 1778.

```
C. q. lb. s. d.
                                             £. s. d.
a Hhds of Sugar, Gross to 3 to
                Tare
                       0 2 10 at 74 op. C.
2 Bar. of Scotch Snuff, Gr. 8 2
                   Ta. 0 2 7 at 1 6 p. lb.
2 Ditto of Pimento, Gr.
                   Ta. 0 2 2 at 1 10
3 Ditto of Figs,
                   Gr. 8 2 11
                   Ta. o 1 27 at 30 o.p. C.
4 Hhds of Treacle,
                   Gr. 11 2 19
                   Ta. 0 2 27 at 14 10 .-
3 Ditto of Prunes, Gr. 10 1 11
                   Ta. 0 2 25 at 17 6 -
```

(17.) Mr. THOMAS BAIL,

Bought of John Silversmith, June 3, 1784.

The same of the same of the same of	oz.	dwt	gr.	5.	d.	£.	. s. d.
A Silver Tankard, wt.	14	2	3 a	t 6	9	per oz.	1334
- Punch Ladle,	0	19	20 a	t 7	2		
- Punch Bowl,	24	1	7.2	t 7	6	Access to	
A Pair of Silver Sauce-boats,	40	11	10 2	17	10	-	
6 Cruet Tops, -	4	9	3 2	t 6	4	-	
6 Cruet Tops, —	62	19	4 a	17	2		
D z. of Dishes, each	26	14	6 at	16	2		
Ditto of Plates,	14	10	9 at	t 6	81		

FINIS

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